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Examining the New Zealand Primary School Food Environment

A thesis presented in partial fulfilment of the
requirements for the degree of

Doctor of Philosophy

In

Nutritional Science

at Massey University, Albany,

New Zealand

Danika Pillay

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I declare that no part of this thesis has been submitted for a degree at Massey University or any other tertiary institution. This thesis describes original research conducted by the candidate, Danika Pillay under the supervision of primary supervisor Professor Ajmol Ali, and co-supervisor Professor Carol Wham.

Abstract

Background

Schools reach most children during key developmental stages, making the school food environment a key factor in shaping nutrition behaviours. However, limited data exists in New Zealand (NZ) on school food environments, the healthiness of canteens, and barriers to policy implementation.

Aims and Objectives

To examine the healthiness of NZ primary school food environments by investigating how national guidance, school-level policies and practices, and surrounding foodscapes influence school food provision.

Methods/Design

An assessment of the healthiness of 133 primary school canteen menus was conducted at the introduction of the guidance. Three-years later, follow-up menus (n=89) were analysed to assess changes in school food availability. Health-promoting practices and barriers to policy implementation were examined through an online survey of 239 primary schools; of these, 80 schools also provided canteen menus which were assessed to investigate the association between school-based food and nutrition policies and barriers on food availability. Geospatial mapping of retail food outlets around these schools assessed the impact of the external food environment on school food availability.

Results

At baseline (n=133 school menus), 41% of menu items were in the 'amber' category and 40% in 'red', while healthy 'green' items comprised 12.8%. At follow-up (n=89), 'amber' items decreased from 44.4% to 33.8% (p=0.005), but 'red' items showed little change (35.4% to 37.5%). In a separate sample of 80 schools, policies had no significant effect on the proportions of 'green', 'amber', or 'red' items available. Approximately, 38.9% of menus from schools requiring 'plain milk and water only' still included sugar-sweetened or red-classified drinks. Reported barriers did not predict policy presence (OR=1.034, p=0.841) or menu composition. The external food environment was highly obesogenic, averaging 45 outlets around schools, with 3.8 times more unhealthy than healthy outlets (p<0.001).

Conclusion

Compliance with national guidance remains low in NZ primary schools, with most canteen items in the less-healthy ‘amber’ or unhealthy ‘red’ categories and minimal improvement over three years. School-level policies, reported barriers, and the external foodscape showed no significant effect on food availability. These findings indicate that voluntary guidance and school-level policies alone are insufficient to enhance the food environment. Mandatory guidelines with consistent monitoring and implementation support are needed to improve school food availability.

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Dedication

This thesis is dedicated to the elders who came before me.

To those who began with so little and gave so much.

Your determination and resilience built the path I walk today.

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Abbreviations

ANGELO	Analysis Grid for Environments Linked to Obesity
AUD	Australian Dollar
BMI	Body Mass Index
COVID	Coronavirus
ECE	Early Childhood Education
EQI	Equity Index
FAO	Food and Agriculture Organisation of the United Nations
FBCS	Food and Beverage Classification System
Food-EPI	Healthy Food Environment Policy Index
HAL	Healthy Active Learning
HPS	Health Promoting Schools
HSR	Health Star Rating
INFORMAS	International Network for Food and Obesity / Non-communicable Diseases Research, Monitoring and Action Support
JBİ	Joanna Briggs Institute
NSW	New South Wales
NZ	New Zealand
NZDep	New Zealand Deprivation Index
OECD	Organisation for Economic Cooperation and Development
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
QLD	Queensland
RCT	Randomised Controlled Trial
RNZ	Radio New Zealand
SCFS	School Canteens and Other Food Services
School-FERST	School Food Environment Review and Support Tool
SSB	Sugar-Sweetened Beverage
TDF	Theoretical Domains Framework

TVNZ	Television New Zealand
UHT	Ultra High Temperature
UK	United Kingdom
UPF	Ultra-Processed Food
US/USA	United States of America
VIC	Victoria
WA	Wales

List of Publications and Presentations from the PhD candidature.

Peer Review Publications

1. **Pillay, D.,** Ali, A., & Wham, C. A. (2023). Examining the New Zealand school food environment: what needs to change? *Nutrition Research Reviews*, 36(2), 406-419. <https://doi.org/10.1017/S0954422422000154>
Impact Factor: 6.6 CiteScore: 14.0
SCImago Journal Rank: Q1, 1.451
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2. **Pillay, D.,** Piddington, M., Ali, A., Wham, C. (2023). Food menus within New Zealand primary school canteens: Do they meet the guidance? *Health Promotion Journal of Australia*. 35(3), 628-637. <https://doi.org/10.1002/hpja.793>
Impact Factor: 1.5 CiteScore: 3.5
SCImago Journal Rank: Q1, 0.697
Citations: 7
3. **Pillay, D.,** Ali, A., & Wham, C. (2024). The effect of healthy food guidance for schools on food availability, purchasing and consumption among school children in New Zealand and Australia: an integrative review. *Nutrition Research Reviews*, 38(2), 571-585. <https://doi.org/10.1017/S0954422424000362>
Impact Factor: 6.6 CiteScore: 14.0
SCImago Journal Rank: Q1, 1.451
Citations: 5
4. **Pillay, D.,** Ali, A., & Wham, C. (2025). Policy v. practice: school food practices do not reflect healthy food guidance in New Zealand primary schools. *Public Health Nutrition*, 28(1), e184. <https://doi.org/10.1017/S1368980025101341>
Impact Factor: 3.4 CiteScore: 6.6
SCImago Journal Rank: Q1, 0.987
5. **Pillay, D.,** Ali, A., & Wham, C. (2026). Three Years Later: Healthiness of Food in New Zealand Primary School Canteens Following Implementation of the Healthy Food and Drink Guidance. *Health Promotion Journal of Australia*, 37(1), e70135. <https://doi.org/10.1002/hpja.70135>
Impact Factor: 1.5 CiteScore: 3.5
SCImago Journal Rank: Q1, 0.697

Publications Under Review

1. **Pillay, D.,** Kishore, S., Ali, A., Wham, C. Does Food Outlet Density Around New Zealand Primary Schools Influence the School Food Environment?
Submitted to Public Health Nutrition

Oral Presentations and Conference Publications

1. New Zealand Nutrition Society Conference, Wellington, December 2021
Pillay, D., Ali, A., Turner, S., & Wham, C. (2022). Barriers to Implementing a Healthy Food and Drink Environment in New Zealand Schools: Baseline Results from the Healthy Active Learning Evaluation. *Medical Sciences Forum*, 9(1), 29.
<https://doi.org/10.3390/msf2022009029>
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2. Australasian Nutrition Society Conference, Auckland, December 2023
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Pillay, D., Piddington, M., Ali, A., & Wham, C. (2024). Assessment of food availability in New Zealand primary schools. *Proceedings of the Nutrition Society*, 83(OCE1), E10.
<https://doi.org/10.1017/S0029665124000284>
Impact Factor: 8.3 CiteScore: 15.6
SCImago Journal Rank: Q1, 1.942

Other related publications

1. Ali A, Carpendale J, Nanavati K, Mumme K, **Pillay D**, Jackson J, Erueti B, Godfrey J, King J, Molchanov S, Adams J, Wood W, Badenhorst C, Powell N, Tolson L, Twigger L, Lindley J, Prince R, Murphy S (2025). Healthy Active Learning: Evaluation Report. Sport New Zealand. <https://sportnz.org.nz/healthy-active-learning/hal-the-impact/>
2. Ali A, Adams J, Bacinski K, Badenhorst C, Carpendale J, Erueti B, Godfrey J, Jackson J, King J, Molchanov, S, Mugridge O, Mumme K, **Pillay D**, Wham C, Wood W, Young M (2023). Healthy active learning: Mid-term evaluation report. Sport New Zealand. <https://sportnz.org.nz/healthy-active-learning/hal-the-impact/>
3. Ali A, Adams J, Erueti B, Godfrey J, Jackson J, King J, Mugridge O, Mumme K, **Pillay D**, Wham C, (2022). Healthy Active Learning: Interim Evaluation Report. <https://sportnz.org.nz/healthy-active-learning/hal-the-impact/>
4. Ali A, Adams J, Badenhorst C, Batty R, Erueti B, Jackson J, Molchanov, S, Mugridge O, O'Brien W, **Pillay D**, Turner S, Walsh D, Wham C, Wood W (2021). Healthy active learning: Interim evaluation report. Sport New Zealand. <https://sportnz.org.nz/healthy-active-learning/hal-the-impact/>

Media Releases

1. TVNZ Breakfast Live: Food Menus in NZ Primary Schools, November 2023
2. Newstalk ZB, November 2023: [Primary school canteens falling short of Ministry of Health guidelines, study reveals \(newstalkzb.co.nz\)](https://www.newstalkzb.co.nz/news/primary-school-canteens-falling-short-of-ministry-of-health-guidelines-study-reveals)
3. Radio New Zealand, November 2023: [Healthy food a fraction of food served in canteens and tuck shops | RNZ](https://www.rnz.co.nz/news/healthy-food-a-fraction-of-food-served-in-canteens-and-tuck-shops)
4. Massey University news, November 2023: [New research reveals many school lunch menus fail to meet Manatū Hauora Ministry of Health guidelines - Massey University](https://www.massey.ac.nz/news/new-research-reveals-many-school-lunch-menus-fail-to-meet-manatū-hauora-ministry-of-health-guidelines)

Researchers' Contributions

Contribution by the PhD Candidate (Danika Pillay) and other researchers:

Researchers	Contribution
Danika Pillay <i>PhD Researcher</i>	- Conceptualisation of the thesis aims and research questions. - Conceptualisation, design, and writing of all thesis chapters and manuscripts. - Searching the literature and completing literature reviews – narrative and integrative. - Development of the Menu Analysis Toolkit used through the empirical chapters. - Data collection for primary school food menus. - Manual coding of all primary school food menus and external food outlets. - Data analysis for all manuscripts. - Drafting manuscripts for journal submission and subsequent manuscript revisions. <i>The Menu Analysis Toolkit:</i> - Under the supervision of Carol Wham and Ajmol Ali, I was involved in liaison with Ministry of Education, Ministry of Health, Sport NZ, Heart Foundation, public health researchers, dietitians, PHOs to inform the development of the menu analysis toolkit. - Liaison with commercial school food providers regarding recipes, portions, and ingredients. - Liaison with schools (administration, canteen providers) regarding menu details. - Conceptualisation, development, and implementation of the Menu Analysis Toolkit. - Provided dietetic supervision to three dietetic Masters students through the toolkit development process. <i>Healthy Active Learning Evaluation:</i> - Under the supervision of Carol Wham and Ajmol Ali, I was involved in liaison with Ministry of Education, Ministry of Health, Sport NZ, Heart Foundation, public health researchers, PHOs to inform the development of the surveys used (Food Policies and Practices survey, Teacher Surveys, Whanau Surveys). - Provided background literature and benchmarking tools to inform the initial development of surveys evaluating the food environment. - Reviewed, edited, and pilot tested 'Food Policies and Practices' survey prior to launch. - Analysed the teacher focus group interviews for reporting on the food environment for the HAL evaluation reports.

	- Nutrition data sense-making, and writing the nutrition and food environment components of the HAL evaluation reports.
Prof Ajmol Ali <i>Primary Supervisor</i>	Conceptualisation and design of the Healthy Active Learning evaluation. Funding and ethics application. Primary oversight of all components of the HAL evaluation. Supervision of the PhD candidate. Reviewing thesis and all manuscripts and revisions.
Prof Carol Wham <i>Co-Supervisor</i>	Conceptualisation and design of the Healthy Active Learning evaluation. Funding and ethics application. Oversight of the food and nutrition related components for the HAL evaluation. Supervision of the PhD candidate. Reviewing thesis and all manuscripts and revisions.
Marsha Piddington <i>Dietetic Masters Student / Nutritionist</i>	Co-development of the Menu Analysis Toolkit (primary schools). Menu analysis validation through intercoder reliability testing at both baseline and follow up.
Shannon Green Olivia Hall <i>Dietetic Masters Students / Nutritionists</i>	Co-development of the Menu Analysis Toolkit (secondary schools, early learning services).
Dr Shohil Kishore <i>Data Analyst</i>	Contracted to collect Google Maps API data on food outlets around schools and to create a map visualisation.
Sophie Turner Owen Mugridge Kyria Bacinski Dr Krutika Nanavati <i>Massey University 'Healthy Active Learning Evaluation' research team</i>	Conceptualisation and design of the Healthy Active Learning Evaluation. Participant identification and recruitment (Phase 1 and Phase 2 specific to Healthy Active Learning). Survey development and management through Qualtrics software. Data collection and data management for the Healthy Active Learning Evaluation ('Food Policies and Practices' surveys, and baseline school food menu collection).
Dr Karen Mumme <i>Statistician</i>	Statistical support for the HAL evaluation data.
Nell Powell Sam Murphy <i>Massey University 'Healthy Active Learning Evaluation' research team</i>	Food outlet categorisation validation through intercoder reliability testing.

Chapter 1

Introduction

This chapter provides background for this thesis and outlines the rationale and objectives of the PhD study. The chapter concludes with an outline of the thesis structure.

1.1. Background

Dietary habits are often shaped during childhood and adolescence through many social, political, physical, and environmental factors (Scaglioni et al., 2018). According to the United Nations and the World Health Organisation, a child is defined as any person under the age of 18 (United Nations, 1989), while adolescents are typically considered to be individuals aged 10-19 years old (World Health Organisation, 2025a). Dietary habits established during childhood and adolescence influence nutrition later in life and have implications for health and educational outcomes (Ministry of Health, 2012; Movassagh et al., 2017). Overweight and obesity in children and adolescents is a global and growing issue despite being largely preventable and manageable. It was estimated that 20% of children and adolescents aged between 5-19 years were considered overweight in 2022, a dramatic increase from 8% in 1990 (World Health Organisation, 2025b). Similarly, obesity rates among children and adolescents aged 5-19 years have quadrupled from 2% in 1990 to 8% in 2022 equating to 160 million people across the globe (World Health Organisation, 2025b). In New Zealand (NZ), approximately one in three children aged from birth to fourteen years are considered overweight or obese (Ministry of Health, 2024a). Children's dietary patterns in NZ have been shown to be suboptimal with only 5.8% of children meeting their recommended intake of vegetables, and approximately a third of children consuming at least one carbonated drink per week (Ministry of Health, 2025). Supporting children through physical activity and healthy eating, in particular limiting consumption of sugar-sweetened beverages and energy-dense foods and increasing consumption of fruits and vegetables, has been suggested among the preventative strategies to promote healthy weight and eating behaviours (World Health Organisation, 2025b).

Schools are an opportune place to promote healthy eating and nutrition behaviours given that children aged 5-16 years spend most of their formative waking hours in a school setting. However, the NZ school food environment has been shown to be highly obesogenic with limited application of food and nutrition policies and unhealthy foods dominating school canteens (Carter & Swinburn, 2004; Chote et al., 2022; D'Souza et al., 2021; Vandevijvere et al., 2019). School canteens have been shown to be laden with unhealthy food options at cheap prices (Carter & Swinburn, 2004). Despite the development of the Food and Beverage Classification system (FBCS) in 2007 designed to help schools provide healthy food and drinks to students, canteens continued to offer heavily processed and unhealthy foods in schools more than a decade later (D'Souza et al., 2021). Canteen-use has been associated with higher consumption of high fat and high sugar foods and beverages in NZ primary schools compared to their non-canteen user counterparts (Carter & Swinburn, 2004; Utter et al., 2007).

Food environment policy, especially healthy food policies in schools, has major implementation gaps in NZ compared to international best practice (Mackay et al., 2020; Swinburn et al., 2014). The Ministry of Health released the 'Healthy Food and Drink Guidance for Schools' in 2020, superseding the FBCS (Ministry of Health, 2020b). The voluntary guidance was implemented as part of the Healthy Active Learning initiative, a joint government initiative between the Ministry of Health, Ministry of Education, and Sport NZ which aims to improve the wellbeing of children and adolescents through healthy eating and drinking and quality physical activity (Sport New Zealand, 2022). The guidance utilises a traffic-light approach to categorise the healthiness of foods and beverages, similar to school food guidelines seen in many Australian states. The level of adherence to the traffic-light school food guidelines in Australia has varied despite being mandated in several states, with many schools still offering 'banned' and unhealthy 'red' food items several years after its introduction (Hill et al., 2015; Silva-Sanigorski et al., 2011; Western Australian Department of Health, 2021).

Alongside the implementation of the 'Healthy Food and Drink Guidance for Schools', the NZ Ministry of Health also released a 'Healthy Food and Drink Toolkit' which detailed how to create an individualised food and nutrition policy and guidance on how to promote a healthy food and drink environment (Ministry of Health, 2021b). It is the responsibility of the schools' board of trustees to promote healthy food and drinks within schools (Ministry of Education, 2024), however, the lack of comprehensiveness and implementation of school food policies in NZ schools has meant that little has changed with regards to the foods available for purchase in school canteens over the last decade (D'Souza et al., 2021). Several barriers to school food policy implementation have been identified in NZ (D'Souza et al., 2021; Mansoor et al., 2017; Vandevijvere et al., 2018a) and internationally (Ronto et al., 2020) including lack of support and training for school staff, lack of acceptance of healthy foods by the school community/parental resistance, density of surrounding food outlets and unhealthy food advertising undermining efforts, lack of prioritisation by the school, and costs to implement. Unfortunately, strategies to overcome these barriers is often not included in nationwide school food guidelines which further exacerbates the issue.

Understanding the school food environment requires moving beyond any single-level domain and considering the effect of multiple interconnected factors that shape children's access to food and dietary behaviours. The socioecological model, originally developed by Bronfenbrenner (1977), and subsequently applied to health promotion by McLeroy et al. (1988), provides a useful theoretical framework for this purpose. It was proposed that health behaviours are shaped by five levels of influence: intrapersonal, interpersonal, organisational, community, and public policy,

and that health promotion efforts are most effective when they target multiple levels simultaneously rather than focussing on individual behaviour change alone (McLeroy et al., 1988). Applied to the school food environment, this model positions the school canteen as an organisational-level determinant of children's food exposure, while school level policies and their implementation of national guidelines act as governance mechanisms operating within and upon that organisational setting. The surrounding retail food environment highlights a community-level influence that may reinforce or undermine efforts to improve food provision within schools. Examining these layers in combination reflects the systems-level complexity of the school food environment and is essential for informing policy and practice that is both comprehensive and effective.

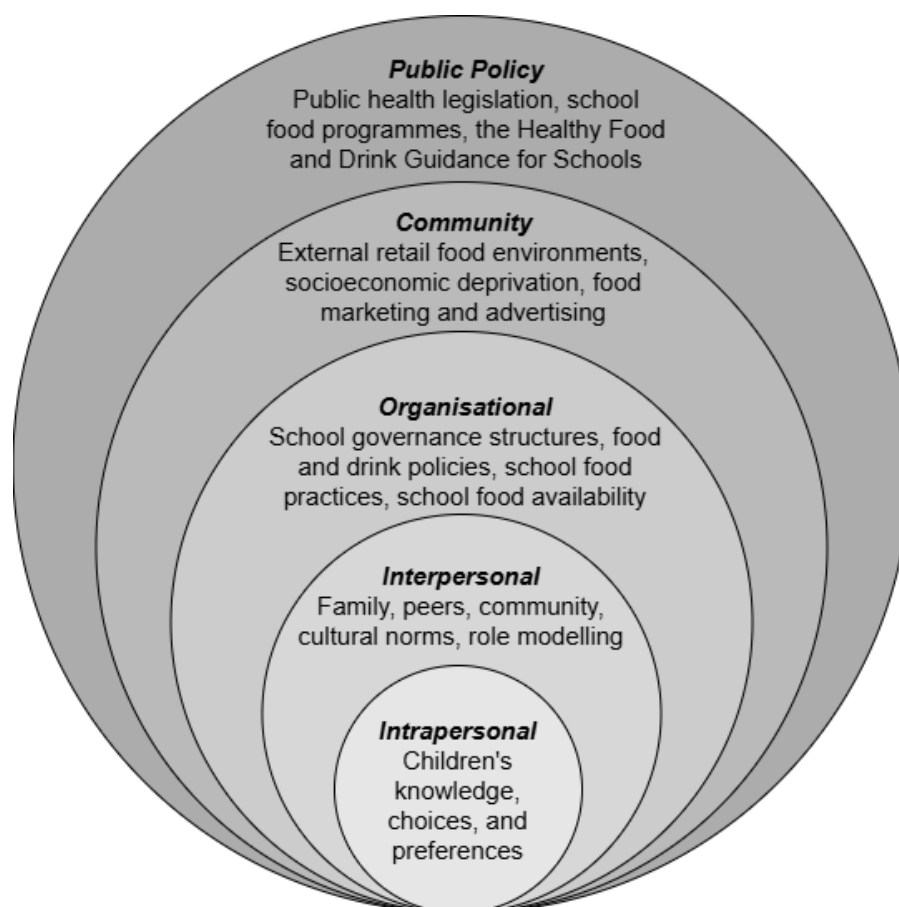


Figure 1.1: Socioecological model of school food environments adapted from McLeroy et al. (1988).

1.1.1. Rationale for this PhD Study

A review of the literature showed that there was limited research on the primary school food environment in NZ. Previous analyses of the healthiness of school canteens in NZ have either been conducted in specific regions of NZ (Walton et al., 2010), were conducted more than 13 years ago (Carter & Swinburn, 2004; Pledger et al., 2012), or utilise the now outdated FBCS (D'Souza et al., 2021). Since the implementation of the 'Healthy Food and Drink Guidance for Schools', there has not been a review of primary schools' adherence to the new guidance, and limited tools exist to assess school canteen menus against the new classification criteria. Understanding adherence to the new guidance is essential to evaluate its effectiveness and inform future policy development and refinement. While many schools in NZ report having a food and drink policy in place, others face significant barriers to developing or implementing one. However, no research to date has examined the relationship between policy presence, implementation barriers, and the healthiness of school canteens. Similarly, previous research has highlighted food 'swamps', areas with a high density of outlets selling unhealthy foods, in low socioeconomic areas (Sushil et al., 2017), and obesogenic food environments around schools (Day et al., 2015; Vandevijvere et al., 2016; Walton et al., 2009) suggesting that external food environments may undermine or disincentivise healthy school canteens. However, no study has investigated the association between external food environments and the effect on school canteen offerings and overall food availability.

1.2. Aims and Objectives

The overall aim of this thesis was to critically examine the healthiness of primary school food environments in New Zealand, by investigating the association between national guidance, school-level policies and practices, and surrounding foodscapes on school food provision.

1.2.1. Research Question 1

What influences the healthiness of school food environments in New Zealand, both within schools and in the surrounding communities?

The influence of economic, political, physical, and socio-cultural factors on the healthiness of school food environments in NZ is explored in a narrative review. The aim is to identify key contextual drivers that shape children's access to healthy food in and around schools.

1.2.2. Research Question 2

How effective are national food and drink guidelines on improving the healthiness of school food provision, and what are the barriers and enablers to successful implementation?

The level of implementation of national food and drink guidelines and the effect on school food provision is examined through an integrative review of studies from both NZ and Australia. The review considers how government-issued guidance has shaped the availability of foods offered in schools, the effect on student purchasing behaviours, and the practical barriers and enablers that affect successful guideline implementation.

1.2.3. Research Question 3

To what extent do New Zealand primary school canteen menus meet the national ‘Healthy Food and Drink Guidance for Schools’?

The nutritional quality of primary school canteen menus is assessed against the Ministry of Health ‘Healthy Food and Drink Guidance for Schools’ to understand how well schools align with national guidelines at the time of policy introduction. Assessment of the implementation of the guidance over time with the same cohort of schools over a three-year period evaluates how the guidance has influenced the nutritional quality of foods offered in school canteens.

1.2.4. Research Question 4

How do school-level policies, perceived barriers, and the surrounding food environment influence the nutritional quality of foods available in New Zealand primary school canteens?

The influence of internal factors such as school food policies, practices, and perceived barriers is examined to understand how they shape the availability of healthy food within NZ primary schools. A broader view of environmental influences is assessed by analysing the association between external food outlets surrounding schools and the healthiness of school canteen menus.

1.3. Thesis Structure

This PhD project follows the format of thesis by publication. An overview of the thesis chapters is presented below with identification of those chapters that have been published or submitted for publication. All references are included at the end of the thesis rather than after each chapter to enhance readability and provide a comprehensive overview of sources in one place.

Chapter 1 provides the background and rationale for this PhD study. It also introduces and describes the overall aims and research questions to be addressed in this PhD project.

Chapter 2 comprises of a narrative review which provides an overview of the NZ school food environment using the ANGELO framework for mapping food environments. This review was published in *Nutrition Research Reviews* (Q1, Impact Factor: 6.6, Cite Score: 14) in 2023.

Chapter 3 presents an integrative review investigating how national healthy food and drink guidelines are implemented in both a NZ and Australian school context, and what enables successful implementation. The effect on student food purchasing is also discussed. This review was published in *Nutrition Research Reviews* (Q1, Impact Factor: 6.6, Cite Score: 14) in 2024.

Chapter 4 presents an overview of all the methodological processes used in the empirical chapters to follow. It includes details on data collection, surveys, participants, menu analysis, geospatial analysis of food outlets around schools, and statistical analysis including visualisation of the data.

Chapter 5 presents the first empirical chapter of this PhD project and investigates to what extent a sample of primary schools were compliant with the Ministry of Health ‘Healthy Food and Drink Guidance for Schools’ at the time of its introduction in 2020. This data was collected as part of the baseline Healthy Active Learning evaluation. A menu analysis toolkit was developed in accordance with the traffic-light criteria imposed by the guidance to assess school food menus. This study was published in the *Health Promotion Journal of Australia* (Q1, Impact Factor: 1.5, Cite Score: 3.5) in 2023.

Chapter 6 is the second empirical chapter and is a longitudinal investigation of the school canteen menus collected at baseline. It examines to what extent school canteen menus have changed over a three-year period since the implementation of the Ministry of Health ‘Healthy Food and Drink Guidance for Schools’. This study was published in the *Health Promotion Journal of Australia* (Q1, Impact Factor: 1.5, Cite Score: 3.5) in 2026.

Chapter 7 is the third empirical chapter and is a cross-sectional examination of the influence of school-level food policies, practices, and perceived barriers on the healthiness of school food canteen menus according to the ‘Healthy Food and Drink Guidance’. This study was published in *Public Health Nutrition* (Q1, Impact Factor: 3.4, Cite Score: 6.6) in 2025.

Chapter 8 is the fourth empirical chapter and is an exploration of the healthiness of food outlets around schools, and whether there is any association with food provision in the school canteen. This study was submitted to *Public Health Nutrition* (Q1, Impact Factor: 3.4, Cite Score: 6.6) in 2025 and is under review.

Chapter 9 discusses the main findings and highlights the conclusions of the PhD project, incorporating all the empirical chapters. It also presents the limitations of the research and recommendations for policymakers and future research.

Chapter 2

Examining the New Zealand school food environment: What needs to change? A Narrative Review.

This chapter presents a narrative review addressing Research Question 1: *What influences the healthiness of school food environments in New Zealand, both within schools and in the surrounding communities?* The narrative review outlines the economic, political, physical, and sociocultural factors that shape the broader school food environment in NZ and was published in *Nutrition Research Reviews* (Q1, Impact Factor: 6.6, Cite Score: 14) in 2023.

This chapter is based on work conducted and reported as of September 2021 and is presented in its original published form. Citation included below:

Pillay, D., Ali, A., & Wham, C. A. (2023). Examining the New Zealand school food environment: what needs to change? *Nutrition Research Reviews*, 36(2), 406-419.

2.1. Abstract

Habitual dietary intakes and nutrition behaviours developed during childhood and adolescence pave the way for similar behaviours to manifest in adulthood. Childhood obesity rates have now reached a point where one in six children globally are classified as overweight or obese. Schools have the unique ability to reach almost all children during key developmental stages making them an ideal setting for influencing children's nutrition behaviours. Evidence suggests the school food environment is not always conducive to healthy food choices and may be obesogenic. The aim of this narrative review is to explore factors that influence the healthy food and drink environment in and around schools in New Zealand (NZ). The review focussed on evidence from NZ and Australia given the close resemblance in education systems and school food guidance. Using the Analysis Grid for Environments Linked to Obesity (ANGELO) framework, the school food environment was categorised into the following domains: economic, political, physical, and socio-cultural factors. Findings suggest that food policies are not utilised within schools, and guidelines to improve the school food environment are not well implemented. Canteen profit-models, lack of staff support and resources, and higher availability of low-cost unhealthy foods are among barriers that hinder implementation. This review highlights recommendations from existing evidence including canteen pricing strategies, restriction of unhealthy foods, and using peer-modelling in a time-scarce curriculum to improve the school food environment. Key areas for improvement, opportunities to enhance policy implementation, and untapped avenues to improve the food and nutrition behaviours of children are highlighted.

2.2. Introduction

Childhood obesity, unhealthy diets, and physical inactivity have strong linkages with the development of non-communicable diseases, and are associated with higher economic burden on the health care sector (World Health Organisation, 2013). In New Zealand (NZ), one in three children aged between 2-14 years are classified as overweight or obese compared to one in six globally (Ministry of Health, 2020a; OECD, 2017). Ethnic disparities also exist within NZ with Māori and Pacific children more likely to be overweight and obese compared to non-Māori and non-Pacific children (Ministry of Health, 2020a). There is a complex relationship between childhood obesity, health, and educational outcomes, particularly when accounting for the non-BMI-related factors, such as physical activity and nutrition, and the food environment (Carey et al., 2015; Guthold et al., 2020; Sport New Zealand, 2020). Dietary habits established during childhood and adolescence are known to influence behaviours in adulthood and may impact health later in life, making it an issue that warrants policy action (Ministry of Health, 2012; Movassagh et al., 2017).

Intervention approaches that exclusively target individual-level determinants such as knowledge, beliefs, and habits have little or no impact long term (Brug et al., 2017; Lakerveld et al., 2012). However, in combination with environmental-change components these individual approaches have greater effectiveness in improving health behaviours (Brug et al., 2017; Sawyer et al., 2021).

The school food environment provides an opportunity for public health interventions to improve the health of children (Mackay et al., 2020). In NZ, school enrolment is compulsory for children aged between 6 and 16 years of age (Ministry of Education, 2000). As a result, primary and secondary schools have the ability to reach almost all children and young people during the first two decades of their lives, making it an ideal setting for influencing children's nutrition and physical activity behaviours (Carter & Swinburn, 2004). The school food environment refers to all spaces in and around schools where food is made available and consumed, and represents an effective setting to influence children's food choices (FAO, 2021). In NZ, food is usually brought from home and/or bought at school. From data collected in the 2002 NZ National Children's Nutrition Survey, more than half of all students (58%) bought some or most of their food and drink from the school canteen (Utter et al., 2007). School food provision varies with some schools providing in-house catering to their canteens, some outsourcing to external catering companies and food providers, and some having a combination of both. Previous mandated legislation sought to improve the food environment within schools, however the requirements for '*only* healthy food options to be sold on school premises' was removed following a change in government in 2009 (Cushman, 2012; Gorton et al., 2009). Since then, the onus has been put onto the schools Board of Trustees to mandate healthy food and drinks within schools (Cushman, 2012; Gorton et al., 2009). Prior to the introduction of the 'Healthy Food and Drink Guidance for Schools' in 2020, schools had been using the 'Food and Beverage Classification System' to help them to make decisions about which foods to provide within schools. It is the schools' responsibility to decide on the types of foods sold within a school canteen or provided to students and manage the cost of this, however, the evidence suggests that the majority of schools still provide unhealthy food options at cheap prices (Carter & Swinburn, 2004; D'Souza, 2017).

The Healthy Food Environment Policy Index (Food-EPI) (Mackay et al., 2020) assessed the NZ Government's level of implementation of policies and infrastructure support for improving the healthiness of food environments against international best practice in 2020. It showed there had been no change in the level of implementation of policies in schools to promote healthy food choices or restriction of unhealthy food promotion to children in settings like schools since recommendations were made in 2014 by an expert panel (Swinburn et al., 2014). Children consume up to a third of their daily food intake at schools (Regan et al., 2008), and data suggests

children consume more snack foods and sugar on school-days (Rockell et al., 2011). Schools have the opportunity to create healthy food environments for children yet an analysis of NZ primary schools found high sales of unhealthy foods, lack of adequate facilities for preparing healthy food, and lack of school management to support the provision of healthy foods (Carter & Swinburn, 2004).

The aim of this narrative review is to explore the factors that influence the healthy food and drink environment in and around schools in NZ. For the purpose of this review, the food environment will refer to the economic, political, physical, and socio-cultural contexts that influence children's food choices (HLPE, 2017; O'Halloran et al., 2020; Swinburn et al., 1999). The 'economic' context refers to financial factors such as food cost and affordability; 'political' context refers to the rules and regulations such as school food policies; 'physical' context refers to the availability of foods and facilities; and 'socio-cultural' context refers to the attitudes and perceptions, with particular focus on children, parents, teachers, and school principals. This framework will be used to ensure broad scoping of the current evidence.

2.2.1. Search Strategy

The review strategy included a literature search using several online databases including Web of Science, Research Gate, PubMed, and NZ-specific journals relevant to public health nutrition and children's nutrition. Search terms included derivatives of key phrases such as "school food environments", "school food policies", "food availability in schools" and/or search terms related to the subsections within the four domains. "New Zealand" or "NZ" was added to purposely find publications relevant to the scope of this paper. There were no filters for date applied in the search criteria. All publications up to September 2021 were considered for inclusion. Papers assessed for inclusion in this review were selected based on relevance by title and abstract. All study designs (observational/experimental) and grey literature (government/institutional reports and guidelines) were considered for inclusion in this review due to the limited available evidence in NZ regarding the school food environment. References were also suggested by other researchers in the same field or obtained from references of relevant articles. NZ literature related to food environments in and around primary and secondary schools was prioritised followed by Australian literature due to their close resemblance to NZ school food guidelines and food provision systems, and then broader international literature with particular attention to systematic reviews to gain a wider understanding of available publications.

2.3. The School Food Environment: What do we know?

2.3.1. Economic Environment

2.3.1.1. Deprivation and Food Insecurity

More than 80% of children in NZ source most of the food they consume at school from home yet children have little control over these foods (Ministry of Health, 2003b; Regan et al., 2008). The ability to have a sufficient quantity and variety of food is influenced by both the available income of the household and the cost of food (Robinson, 2011). An analysis of median household income and expenditures in NZ found approximately 23.4-52.4% of net income for families on low incomes and benefits was needed to purchase a healthy “basic” diet (Robinson, 2011). Similar results were modelled for Māori and Pacific diets where 15.2%-43.9% of household income (ranging from median household income of NZD\$1733 to sole income support of NZD\$636 per week) would be required to purchase a healthy diet with the inclusion of culturally important foods (Mackay et al., 2018).

More than a third of children living in the most-deprived neighbourhoods experience moderate-to-severe food insecurity (Ministry of Health, 2019). Food insecurity can be defined as the lack of access to sufficient, safe, and nutritious foods to lead a healthy and productive life, and is an indicator of socioeconomic distress and hardship (Ministry of Health, 2019). Food insecurity is disproportionately more prevalent among Māori and Pacific children and is related to larger households and lower income (New Zealand Government, 2021). Household deprivation also plays a significant role in the nutrition behaviours of children (Carter & Gunasekara, 2012; Ministry of Health, 2019). Evidence suggests that household food insecurity may lead to the selection of relatively cheap and unhealthy foods, and may also decrease the individual’s motivation to eat healthily (Sawyer et al., 2021). In NZ, 20% of children aged 0-15 years live in households that report that food ‘ran out often’ or ‘sometimes’, making it difficult to consume nutritionally balanced diets (New Zealand Government, 2021). Children living in the most deprived neighbourhoods are more likely to consume sugar-sweetened beverages and takeaways, and are significantly less likely to meet the recommended fruit and vegetable intake, and have breakfast everyday (Ministry of Health, 2020a).

Food insecurity is not a new or novel issue with regards to the health of children. Barriers to children’s fruit and vegetable consumption were noted by key stakeholders (government/regulatory sectors, produce industry, retail, and public health/nutrition promotion sectors) in NZ which included negative perceptions of price, living in low-income households and poverty, and having a low food budget (Gerritsen et al., 2019). The cost of food and perceived

value for money have also been noted as significant barriers to children's healthy eating behaviours by NZ school principals and general practitioners (Williden et al., 2006). Despite the known food insecurity issue, children's hunger has often been portrayed as a failure within the family and stigmatised accordingly in NZ (CPAG, 2011). As a result, many children living with food insecurity may be kept at home on school days when they are not able to have breakfast or lunch to avoid the attention to hardship and associated stigma (CPAG, 2011).

2.3.1.2. Costs within Schools

Outsourcing of canteens and the need for schools to return a profit through canteens and fundraising events may be a major obstacle to providing children with healthy food and drink. Canteen use in NZ schools has been associated with frequent consumption of high sugar and high fat foods, as well as increased likelihood of consuming sugar-sweetened beverages and meat pies/sausage rolls (Utter et al., 2007). This is consistent with findings in Australia where children purchasing food from a school canteen tended to consume more energy from fast food, packaged snacks, desserts, chocolate, and confectionary compared to their canteen non-user counterparts (Bell & Swinburn, 2004). Although child-factors such as food preferences and knowledge may play a role in canteen choices, food cost is also a significant driver of their decision making. Children aged 9-12 years old in Australia suggested that improving the affordability of healthier foods sold at the canteen would likely influence their purchasing decisions (Cleland et al., 2004). Yet, an analysis of NZ school food services and canteens found that unhealthy foods such as chips, cakes/biscuits, sausage rolls, and pies were the cheapest menu items, with sandwiches and filled rolls as the most expensive, and more unhealthy foods were sold each week as a result (Carter & Swinburn, 2004). The 'Healthy Food and Drink Guidance for Schools' recently published by the Ministry of Health provides guidance for developing a school food policy and classifying 'red', 'amber', and 'green' food items with recommendations for what foods should be available in schools (Ministry of Health, 2020b). However, pricing strategies to encourage healthy food purchases at schools are not addressed. In Australia, where a similar traffic-light guidance for schools has been adopted, a recent investigation found that 'amber' and 'red' food items were the cheaper option compared to 'green' foods, particularly in more disadvantaged areas (Billich et al., 2019; Wyse et al., 2017). This highlights the cost of healthy food items available in schools need to be more affordable and pricing strategies to promote healthy food consumption may need to be part of a food policy.

2.3.2. Political Environment

2.3.2.1. Implementation of Healthy Food and Drink Policies in Schools

School food policies have the potential to increase healthy food availability in schools, and targeted school food and nutrition policies have been shown to increase fruit and vegetable consumption, reduce intake of sugar-sweetened beverages, and reduce intake of unhealthy snacks in children (Micha et al., 2018; Milder et al., 2015). It is more likely that actions become structural if a policy on healthy nutrition is developed (Milder et al., 2015). Food environment policies, especially for healthy food policies in schools has major implementation gaps in NZ compared to international best practice (Mackay et al., 2020). In the 'School Food Environments Review and Support Tool' (School-FERST) study with 816 participating NZ schools in 2016, only 38.5% of primary and 44.8% of secondary schools reported having a written food and nutrition policy (Vandevijvere et al., 2018a). Of those schools that had a nutrition policy, the strength and comprehensiveness of that policy was extremely low. Schools can provide a healthier beverage environment for students by curbing the availability of sugar-sweetened beverages and selling plain milk only alongside adequate provision of fountains to provide drinking water, otherwise known as a 'milk and water only' school (Ministry of Health, 2020b). However, only two-thirds (67.5%) of primary schools self-reported to be a 'milk and water only' school, significantly higher than that of secondary schools (23.3%) (Vandevijvere et al., 2018a).

Among a sample of Wellington (NZ) primary schools, although many had been thinking about or were in the process of implementing an official or unofficial water-only policy to help to curb children's consumption of sugar-sweetened beverages, only 28% had actually implemented a water-only policy (Mansoor et al., 2017). Barriers to school food policy implementation identified in a recent meta-analysis included lack of support and training for school staff, lack of acceptance of healthy foods by the school community, unhealthy fundraising practices, lower level of priority, and costs to implement the policy if needing to provide healthier foods or install canteen facilities and drinking water fountains (Ronto et al., 2020). Similarly, the lack of prioritisation and value by schools, and parental resistance were significant barriers to school policy implementation in NZ (Mansoor et al., 2017; Vandevijvere et al., 2018a). Support from school staff members and concerns for children's health tended to contribute to a successful implementation of a healthy food and beverage policy (Ronto et al., 2020).

Despite parental buy-in being perceived as a significant barrier, studies in Australia and NZ have shown that there is parental support for the implementation of a food policy. Williden et al. (2006) reported that 67% of a sample of parents of children aged 5–12 years in NZ (n=101) thought that implementing a food policy to restrict unhealthy food would help their child eat more nutritious

foods. Pettigrew et al. (2013) reported that 91% of a cohort of parents of children aged 4-18 years in Australia (n=1200) felt that a policy was a good opportunity to teach children about healthy eating and 62% agreed that a healthy food and drink policy reflected their own views on children's diets. Where parents were identified as a barrier to policy implementation, it was mainly reported that the perceived lack of freedom that their child had to choose what to eat or buy impacted their support (Ronto et al., 2020). This could highlight that communication and understanding between schools and parents is a critical step to getting parental buy-in for a healthy food and beverage policy. In relation to profitability, implementation of a school food policy between 2006 to 2008 using a traffic-light system in Australian school canteens resulted in an increase in the number of schools achieving break-even, with no significant changes to profit or loss at the canteen (Pettigrew et al., 2012a). A harder one to address is the issue of the schools' prioritisation and value on implementing a healthy food and beverage policy (Mansoor et al., 2017; Vandevijvere et al., 2018a) and further investigation is needed to identify barriers and enablers to implementing a healthy school food policy in NZ.

2.3.2.2. The 'Healthy Food and Drink Guidance' for Schools

National governments and the food industry are the two major stakeholder groups with the greatest capacity to modify food environments and population diets (Swinburn et al., 2014). In 2020, the Ministry of Health introduced the 'Healthy Food and Drink Guidance for Schools' in an effort to help schools to develop a policy to improve access to healthy food and drinks with a traffic-light food and beverage classification system (Ministry of Health, 2020b). The guidance suggests that the school canteen should be made up of at least 75% 'green' food items, and that 'red' food items should not be available for students (Ministry of Health, 2020b). The traffic-light system is easy to understand and effective which makes it appealing as a tool to promote healthy food and drink choices (Borgmeier & Westenhoefer, 2009; Kelly et al., 2009). The effectiveness of this traffic-light policy in NZ schools or communities has yet to be evaluated.

However, a similar guidance using a traffic-light based classification system was implemented in Victoria, Australia in 2006 (VIC Department of Education and Early Childhood Development, 2006), yet five years later and despite the guidance, an analysis of 106 Victorian primary and secondary schools found that 37% of school menus still contained 'banned' food items, and the largest proportion of items on the menu (51%) belonged to the 'amber' food category (Silva-Sanigorski et al., 2011). No school had a menu with >50% 'green' items as recommended. Similarly, in 2020, only 58% of Western Australian schools (n= 576) met their 'Healthy Food and Drink in Public Schools Policy' which was implemented in 2014, with 18% still offering unhealthy food or drinks (Western Australian Department of Health, 2021). Despite this, the

implementation of a traffic-light policy in schools has a potential community benefit. In Australia, the implementation of a traffic-light school food policy had influenced 24% of parents' decisions at the supermarket, since classifying foods as 'green', 'amber', and 'red' assisted them in evaluating the general healthiness of foods sold in the supermarket (Pettigrew et al., 2012b). The evidence suggests that the guidance alone may not be enough to increase the healthiness of the school food service and there needs to be greater investment in resources to implement and support these policies, however, benefits of successful implementation of a school food and beverage policy could potentially have wider scope than just the school environment.

2.3.2.3. Health Promotion Strategies in New Zealand

An overview of previous and current strategies used to promote nutrition in schools is presented in Table 2.1. The data highlights that external school support has been useful for improving the school environment in different ways. For example, incentivised schemes like the *Healthy Heart Award* have been successful in reducing sales of less nutritious foods in schools and helping schools and early childhood education (ECE) centres to meet the dietary guidelines (Carter & Swinburn, 1999; Gerritsen et al., 2017). Programmes that provided nutrition guidelines such as *Fuelled4Life* were not very successful in changing food provision (Edirisuriya et al., 2015). The food and nutrition knowledge of teachers and students were improved with curriculum-linked programmes such as the *Heart Start Toi Toi Manawa* programme, *Fuelled4Life*, and *Garden to Table* (Dickinson & Gregory, 2013; Edirisuriya et al., 2015; Soupen et al., 2017). Some programmes that taught wider skills through label reading and supermarket tours such as the *Food for Thought* programme had wider benefits with knowledge extending out towards the community and influencing dietary choices of parents and caregivers (Food For Thought, 2016). Food provision programmes such as *Milk in Schools*, *Fruit in Schools*, *KidsCan*, and *KickStart Breakfast* saw improvements in children's hunger, concentration, and general health (Ball & Watts, 2015; KickStart Breakfast, 2019; Marsh et al., 2018). *Milk in Schools* and the *Ka Ora Ka Ako* (Healthy School Lunch) programme also saw increases in the daily intake of nutritious foods like milk and milk products, and fruits and vegetables, respectively (Marsh et al., 2018; Peirce et al., 2021). Where there have been external organisations actively working with schools the outcomes have been more favourable which suggests that schools could benefit from additional support to promote a healthy food and drink environment.

Table 2.1: Food and Nutrition Promotion in Schools: Previous and Current Strategies in New Zealand.

Initiative	Provider	Year	Intervention	Evaluation/Outcomes
<i>Healthy Heart Award</i>	NZ Heart Foundation	1989 – Present*	An incentive scheme which rewarded schools with a Heartbeat Award if they met set criteria to improve their food service (food policies/food availability) which could be applied for annually. Due to low-level of support needed, it was successfully implemented on a national scale.	Incentivised schools to reduce sales of less-nutritious foods in schools (Carter & Swinburn, 1999). Continued participation was associated with a reported reduction in sales of less-nutritious foods, and increased sales of healthier foods such as sandwiches and filled rolls. More ECE centres were likely to meet dietary guidelines for recommended servings of different food groups if they were participating in the Healthy Heart programme (Gerritsen et al., 2017).
<i>HEART START: Toi Toi Manawa</i>	NZ Heart Foundation and Ministry of Health	2014 – 2018	A curriculum-linked programme which was offered to schools across NZ. Schools could choose which modules they wanted to complete so allowed for individuality. Also encouraged healthy food and drinks to be sold at school canteens. Contained 13 modules including tuckshop rules/guidelines and Fuelled4Life.	Student surveys showed 78% of learners agreed that activities from the Heart Start programme had helped them to learn more about healthy food (Soupen et al., 2017). 56% of schools said their involvement with the programme led to a development of a school food policy. Some changes to food availability occurred. 58% felt that their involvement in the programme led to the provision of healthier food in their school canteen. 81% of staff surveyed felt that it had improved their knowledge and awareness of healthy eating and physical activity. The modifiability of the programme was appealing to schools. No educational or social benefits were noted (Soupen et al., 2017).
<i>Foodstuffs Food for Thought programme</i>	Foodstuffs NZ and NZ Heart Foundation	2007- Present*	An educational tool to assist NZ primary school teachers to support their students to make healthier food and lifestyle choices. It was created to assist the teaching of food and nutrition in primary school aged children. The programme was designed to be completed over one term including two classroom sessions with a nutritionist and supermarket tours.	Families with children who participated in the programme were less likely to buy foods considered unhealthy compared to non-participants. Families also significantly decreased their purchase of unhealthy foods compared to 12 months prior. (Food For Thought, 2016). Students felt that the Food for Thought programme helped them learn more about the nutritional content of foods available in supermarkets, how to read food labels, and resulted in greater awareness of front of pack labelling (Soupen et al., 2017)

<i>Healthy Families NZ</i>	Ministry of Health	2015-Present*	A large-scale initiative by the Ministry of Health to improve people's health where they live, learn, work, and play. Focussed on supporting and improving health promoting environments to enable people to make good food choices, be physically active, smoke-free, and free from alcohol related harm. Local strategic leadership groups in each location are responsible for supporting, driving, and influencing change in their communities.	Not solely focussed on the school environment but evaluation found that the programme did positively influence the provision and promotion of water and removal of SSBs in schools (Matheson et al., 2018). Food gardens were established in schools through collaboration with partners. However, it was too soon to see the programme making a change to chronic disease risk factors (Matheson et al., 2018).
<i>Health Promoting Schools (HPS)</i>	Ministry of Health	1997-Present*	An external support workforce where HPS facilitators help schools work with their community to identify and address health and wellness needs and priorities.	Schools that are participating in the HPS service saw increased positive outcomes for students including improved attendance rates, decreases in stand-downs and suspensions, improvements in learning and performance in reading (Leeson, 2017). The degree of support and communication given by the HPS facilitator to schools strongly predicted the overall successfulness of an HPS school (Leeson, 2017).
<i>Fuelled4Life</i>	NZ Heart Foundation and Ministry of Health	2012-2020	Provided nutrition criteria, tools, and resources to support schools and early learning services to improve the food they provided. Also known as the Heart Foundation 'Food and Beverage Classification System'.	An evaluation of the programme found that there was a more significant increase in awareness and knowledge of healthy eating compared to changes in food provision (Edirisuriya et al., 2015). In 2015, 63% of ECE services had heard of Fuelled4Life, of those, 70% used the tips and recipes, but few found the buyers-guide useful (Edirisuriya et al., 2015). Less than 15% of schools reported changes to their food provision as a result of Fuelled4life (Edirisuriya et al., 2015). Less than half of privately run ECE centres met the recommended serves of breads and cereals, milk and milk products, and meat and meat alternatives as stated in the guidelines (Gerritsen et al., 2017).

<i>Ka Ora, Ka Ako: Free Healthy School Lunches</i>	NZ Government	2020-Present*	A NZ Government initiative focussed on reducing food insecurity among NZ children. Part of the NZ Government's 'Child Youth and Wellbeing Strategy'. Providing free and healthy school lunches to schools and kura with the highest concentrations of learners from disadvantaged backgrounds on a daily basis (Peirce et al., 2021).	Pilot study looking at provision on free school lunches in Hawkes Bay and Bay of Plenty schools part of Ka Ora Ka Ako (Peirce et al., 2021). Those with insufficient food prior to the provision of the free school lunches reported a 20% gain in fullness. Schools receiving the free school lunch saw a 40.6% increase in having at least one vegetable available in lunches, compared to only a 1.6% increase in schools not receiving the free lunch. The proportion of lunches that did not contain any snack or sweet items also increased by 14.7% among schools receiving the free lunch. Children receiving the free lunch on average consumed 0.88 (+/- 0.24) more vegetable items and 0.52 (+/- 0.28) fewer snacks and sweet items at lunch every day. Small benefits observed for quality of life, and physical and emotion functioning. No clear benefits with regards to school attendance.
<i>Fruit in Schools</i>	Ministry of Health	2005-Present*	A food provision initiative providing students with a piece of fruit every school day. Schools in high deprivation areas are eligible for the programme with fruit being delivered to the school by local providers.	Evaluation was undertaken by Ball and Watts (2015). 87% of school Principals highly rated Fruit in Schools as having a very positive effect. 85% of principals reported their school had fewer hungry children because of the programme. 72% of principals felt that fruit provision enabled children to stay on task and increased concentration in the classroom. Observed benefits to children included improvement in general health, fewer sores and skin infections, and reduced sick days. Most agreed that the programme contributed to awareness among staff and pupil about healthy eating, eating fruits and vegetables, and nutrition and health (Ball & Watts, 2015; Boyd et al., 2007; Watts, 2018). Parents reported that their children ate more fruit as a result of the programme, and 39% of families reported that the whole family eats more fruit as a result of the programme (Watts, 2018).
<i>KickStart breakfast</i>	Sanitarium, Fonterra, Ministry	2009-Present*	A food provision initiative where the Ministry of Social Development partnering with	Uptake of the KickStart programme was associated a reduction in the proportion of students with a dental surgery

	of Social Development		Fonterra and Sanitarium provides Weetbix and milk every school day.	outpatient appointment (Wilson et al., 2018). Schools reported improvements in general health and wellbeing of students (75.6%), improvement in concentration levels (74.8%), improvements in children's behaviour (60.5%) (KickStart Breakfast, 2019). A previous intervention study in NZ schools on the provision of a free breakfast in schools was not found to significantly affect children's school attendance and academic achievement, however did significantly decrease children's reported short-term hunger (Mhurchu et al., 2013).
<i>Garden to Table</i>	Charitable Trust	2008-Present*	Established to develop and introduce a curriculum-linked food education programme in NZ. A food education programme that connects gardening, cooking, and academic learning.	Evaluation of Garden to Table was undertaken in 2013 with results showing that there were no associations between the Garden to Table programme and children's fruit and vegetable variety or consumption (Wakefield, 2013). However, knowledge about cooking and gardening was significantly higher in Garden to Table schools (Dickinson & Gregory, 2013). Children were significantly more likely to have positive attitudes towards cooking, gardening, and fruits and vegetables if they were in the Garden to Table schools (Dickinson & Gregory, 2013; Wakefield, 2013).
<i>Milk in Schools</i>	Fonterra	2013-2020	A food provision initiative that provided all primary-school aged children with a 200mL serving of low-fat UHT milk every school day to increase milk consumption.	The proportion of children meeting NZ guidelines for milk and milk product consumption increased significantly from baseline to 2 years follow-up (72% to 84% respectively; $p < 0.05$). 72% of parents agreed that the programme positively impacted their child's health (Marsh et al., 2018).
<i>KidsCan</i>	KidsCan Charitable Trust	2005-Present*	A food provision initiative. Decile 1-4 schools can apply to partner with KidsCan. Food is made available to schools through KidsCan including bread, baked beans, muesli bars, yoghurt, and fruit. The programme was designed to address child poverty through the	An analysis from GoodMeasure on the social impact of KidsCan saw that for every \$1 invested was likely to lead to a \$2.80 return on investment to NZ through several outcomes including improved physical health, educational outcomes, and reduced public healthcare costs (Impact Lab, 2020). Evaluation of KidsCan in ECE was undertaken by the

			provision of food, clothing, and other essential items.	University of Waikato in 2020. From this, KidsCan reported that children were more engaged with learning, had increased energy and attention spans, and had fewer minor health issues like coughs and colds as a result of KidsCan support (KidsCan, 2020). The full results of the evaluation were not made accessible to the author.
<i>Project Energize</i>	Waikato District Health Board and the Regional Sports Trust (Sport Waikato)	2004-2020 [#]	An external workforce initiative where ‘energizers’ employed by Sport Waikato supported schools to improve the health of their students by facilitating school changes and accessing regional initiatives to improve children’s physical activity and nutrition. The programme was designed to improve childhood obesity and cardiovascular risk.	A two-year evaluation found that Project Energize showed a trend for reduced rate of rise in systolic blood pressure and accumulation of body fat (Rush et al., 2012). However, there was no significant change in BMI. A five-year evaluation reported that both younger and older children were 31% and 15% less likely to be overweight or obese, respectively, if they were in the ‘Energized’ schools (Rush et al., 2014). Physical fitness was also improved.

Abbreviations: ECE (Early Childhood Education); NZ (New Zealand); SSBs (Sugar-Sweetened Beverages); HPS (Health Promoting Schools); UHT (Ultra-High Temperature processing); BMI (body-mass index).

Definitions: ‘kura’ – a school, typically one where lessons are conducted in Māori

* Present in 2021.

[#] As of 2021, Project Energize continues in Wellington and some parts of Northland New Zealand funded by individual district health boards, however it was ceased in Waikato due to district health board funding cuts.

2.3.3. Physical Environment

2.3.3.1. Internal School Food Environment

2.3.3.1.1. School Food Availability

Food availability in schools has an important role to play in promoting healthy food and drink choices. Children aged 9-12 years in Australia have identified that increased availability of healthier food options would positively influence their purchasing choices (Cleland et al., 2004). Yet, the main barrier to this is that the unhealthy alternatives are preferable. The NZ 'Healthy Food and Drink Guidance for Schools' suggests increasing availability of healthy 'green' foods and limiting 'amber' and 'red' foods. Yet, food sales from five Wellington (NZ) schools showed that the 'sometimes' and 'occasional' foods still accounted for higher proportion of total sales even when they had restricted availability (Walton et al., 2010). In 2019, as part of the 'New Zealand Child and Youth Wellbeing Strategy', the government introduced the free and healthy school lunch programme, 'Ka Ora, Ka Ako' (Ministry of Education, 2021). Prior to the implementation of 'Ka Ora Ka Ako' in the Hawkes Bay and Bay of Plenty regions (NZ), snacks and sweet items, and select fresh fruits were regularly available in the majority of lunches, with 88.6% of children having at least one snack or sweet item (Peirce et al., 2021). Many children (72.5%) did not have any vegetables available for lunch over the four-day period evaluated prior to the implementation of 'Ka Ora Ka Ako'. Around 25% of students will be provided free school lunches by the end of 2021 and the providers of the school lunch programme will be required to meet the 'Healthy Food and Drink Guidance for Schools' (Ministry of Education, 2021). It is not yet known how this will affect school food availability, particularly in school canteens.

From previous analyses, canteen use has been associated with higher consumption of high fat and high sugar foods and beverages in NZ primary schools (Carter & Swinburn, 2004; Utter et al., 2007). Many NZ primary school students purchase some or most of the food they consume at school from the canteen, and are more likely to consume soft drinks, chocolate, sweets/confectionary, pies, and sausage rolls, compared to their non-canteen user counterparts (Carter & Swinburn, 2004; Utter et al., 2007). In Australian primary schools, despite their similar traffic-light guidance, foods classified as 'green' and 'amber' were on par with their availability in the school canteen, yet 'amber' food items were the most frequently purchased (Clinton-McHarg et al., 2018). Prediction models suggest that the school canteen needs to consist of more than 70% 'green' food items for the majority of children's food purchases to consist of healthier foods (>50%) (Clinton-McHarg et al., 2018). An analysis of South Australian schools (n=14) suggested that barriers to implementing a healthy canteen included lack of staffing to prepare more time-

consuming menu items, the need to return a profit, food preferences of students, and lack of adequate facilities for healthy food preparation (Drummond & Sheppard, 2011).

Previously, vending machines were found to be rare with only 3.5% of NZ schools (n=200) found to be operating one (Carter & Swinburn, 2004). However, among those that did operate a vending machine, soft-drinks, fruit juice and milk were sold more often. Similarly, analyses of Dutch and Australian schools reported that vending machines containing sweets and sugar-sweetened beverages were more prevalent compared to vending machines with fresh products (Drummond & Sheppard, 2011; Milder et al., 2015). Healthier beverage consumption is influenced by availability and access; having access to water-fountains has been shown to increase water consumption, which may displace the consumption of sugar-sweetened beverages (Pearson et al., 2014). Access to water-fountains in Wellington (NZ) was high in school environments and, although not statistically significant, the rates of water fountains was higher in more affluent areas, and rates of access to sugar-sweetened beverages higher in more deprived areas (Pearson et al., 2014). Making healthy beverage choices easy and equitable needs to start with increasing access to healthy drink options, such as water and milk, and decreasing access to sugar-sweetened beverages.

2.3.3.1.2. School Curriculum

Children spend most of their weekday waking hours in the classroom therefore interventions at a school level play a key role in the promotion of healthy lifestyle behaviours. A meta-analysis looking at teaching approaches and healthy eating outcomes reported that many teaching tools including curriculum-based approaches, experiential learning, and cross-curricular approaches were useful for significantly reducing energy intake, increasing fruit and vegetable consumption, reducing sugar consumption, and increasing nutrition knowledge in children (Dudley et al., 2015). However, most studies within the meta-analysis were from the USA or UK and generalisability to the NZ curriculum and child-outcomes is yet to be explored. The current NZ curriculum identifies that health and physical education is a key learning area with focus on health education, physical activity, and home economics (Ministry of Education, 2015); 'food and nutrition' is considered one of seven key areas of learning within this domain. The 'National Administration Guidelines' state that the board of trustees is required to promote healthy food and nutrition for all students (Ministry of Education, 2020b). However, teachers face numerous barriers to providing nutrition education to students including lack of knowledge and value on the topic, teachers' confidence and capability to deliver the programme, lack of resources, lack of training, and insufficient time (de Vlieger et al., 2019; Jones & Zidenberg-Cherr, 2015; Rapson et al., 2020). Integrating nutrition education into core subjects such as mathematics, science, and literacy may be a solution to the

barriers reported (Follong et al., 2021). In a scoping review of 39 articles including literature from Europe and the USA, curricular integration in primary schools was perceived by teachers as valuable and easy to implement, had a positive impact on teaching time, and improved the nutrition knowledge of children (Follong et al., 2021).

Access to support services, for example, the Heart Foundation *Healthy Heart* programme, or *Health Promoting Schools* (HPS) (Table 2.1) has also supported some teachers and schools to deliver this part of the curriculum. Primary schools that are a part of HPS were doing a better job in promoting student wellbeing compared to schools that were not (Education Review Office, 2017a). Schools and teachers are key players in promoting healthy food and drink consumption, but more work needs to go into supporting teachers to be able to do this. Intervention strategies that offered curriculum support, including *Heart Start: Toi Toi Manawa*, and *Food for Thought*, showed positive results for students' learning and teachers' confidence suggesting that external nutrition education support through a health promotion workforce may be an avenue to explore in the future.

2.3.3.2. External School Food Environment

Oftentimes students are still purchasing unhealthy food items at outlets outside of the school which may disincentivise schools to attempt to improve the internal school food environment (Walton et al., 2009). A study of five schools in Wellington (NZ) found that a high percentage of students were likely to pass food outlets and outdoor food advertisements on the way to and from school (Walton et al., 2009). Children's interactions with convenience stores were analysed as part of the Kids' Cam cross-sectional study in NZ (McKerchar et al., 2020). The findings showed that 22% of the participating children (n=168) visited a convenience store within a four-day period. From the photos collected, it was obvious that non-core food and drink items dominated their core counterparts at a rate of 8.3 to 1, and this was then reflected in the purchasing behaviours of children with non-core food items dominating total purchases (94.6%) over the study period. In NZ, access to food retailers is significantly higher in more deprived compared to less deprived areas (Sushil et al., 2017) and it has been shown internationally that children with less desirable eating habits are likely to be found in areas dense with easily accessible outlets selling mainly snack foods and takeaway meals (Hackett et al., 2008). However, correlation does not equal causation. An international systematic review found very little evidence suggesting that the retail food environment around schools affected food purchases and consumption (Williams et al., 2014). This was further supported by a study of mid-high decile schools in Otago (NZ) with results suggesting that children's dietary quality and consumption was not associated with having easy access to local food outlets around schools (Clark et al., 2014). Despite conflicting evidence,

experts in NZ have called for action with regards to zoning laws to create healthy community food environments (Mackay et al., 2020) with reference to international best practice including ‘Green Food Zones’ which ban the sale of fast foods and soft drinks within 200m of schools in Korea, and prohibition of fast food restaurants within 500 ft. of all schools in Detroit, USA (Swinburn et al., 2014). Further research on the retail food environment around schools and children’s consumption behaviours is needed, particularly in low-decile and more socioeconomically deprived areas, to support public health action to regulate food outlets around schools.

Although access to food outlets and children’s consumption still warrants more research, advertising is significantly associated with greater consumption of unhealthy food and beverages by children (Boyland et al., 2016). NZ school neighbourhoods are surrounded by junk food marketing and more than 60% of the advertisements are considered in breach of the restrictions imposed by the ‘Advertising Standards Authority: Children and Young Peoples Advertising Code’ (Vandevijvere et al., 2018b; Walton et al., 2009). The ‘Food Industry Taskforce Report to Ministers’ in 2018 outlined suggestions to restrict fixed outdoor advertising of foods high in saturated fat, sugar, and salt within 300m of the main gate of schools (Food Industry Taskforce, 2018), yet, a recent 2020 study using Google street view data around NZ schools, 12.8% of all bus-stop advertisements within a 500-m distance of schools were for non-core food items (Huang et al., 2020). Given the higher density of food outlets in areas of higher deprivation, it is unsurprising that the proportion of junk food advertising is also significantly higher around low decile schools (Huang et al., 2020; Vandevijvere et al., 2018b). Aside from traditional advertising through physical and televised media, children are now also more vulnerable to food marketing through the internet and social media. Although in NZ the extent of food marketing on popular, non-food websites was found to be low, a wide range of marketing techniques and features were identified on food brand websites that specifically targeted children, including games and free downloadable items (Vandevijvere et al., 2017). Unfortunately, NZ falls short of international best-practice standards, with significant gaps in the implementation of policies that restrict the promotion of unhealthy foods to children through broadcast and non-broadcast media and within children’s settings (Mackay et al., 2020; Swinburn et al., 2014). This leaves children especially vulnerable to unhealthy food and beverage marketing, given that they do not yet possess the cognitive ability to process, comprehend, and evaluate the intent behind advertising (Story & French, 2004).

2.3.4. Sociocultural Environment

2.3.4.1. Child factors: Food preferences, knowledge, and attitudes

Elements of the sociocultural environment are broad and variable in the current published literature, and open to situational or discipline-specific bias. However, food knowledge, self-efficacy, food beliefs, peer modelling and social relationships, parental influence, cultural beliefs, and sensory appeal have been identified as high priority research areas for school-aged children (Renner & Stok, 2021; Stok et al., 2017).

By the age of six years, environmental factors that influence children's decision making are already set (Stewart et al., 2006). Both international (Noble et al., 2000; Stewart et al., 2006) and NZ (Dresler et al., 2017) studies have found that children do have good knowledge about the general healthiness of foods and are able to identify fruits and vegetables as being healthier compared to packaged food items like chips (crisps) and sweets. Knowledge of healthy foods does not necessarily influence food preferences; this was highlighted in NZ where children from the Manawatu region were asked to construct a 'healthy' lunchbox and then construct their 'dream' lunchbox (Dresler-Hawke et al., 2012). Most children (95.4%) selected fruits and vegetables to be in their 'healthy' lunchbox, compared to only 57.7% including these in their 'dream' lunchbox. The top four food items in the 'dream lunchboxes were chocolate bars, donuts, lollies, and chips. Interestingly, when asked about what their diet might be as adults, children aged 6-11 years in Wales with preferences for chips and sweets said that they would likely shift to eating more fruits, vegetables, and meat (Stewart et al., 2006).

Children's preferences for fruit and vegetables are wide and variable. While some children in NZ may find misshapen fruit and vegetables unacceptable, others find them more appealing due to their interesting shapes (Makhal et al., 2020). Their preferences may also not be necessarily guided by learned experiences, for example, if they did not enjoy broccoli, they may perceive other green vegetables to be less appealing too out of fear that their senses will not be satisfied (Dresler et al., 2017). The NZ 'Food and Nutrition Guidelines for Healthy Children and Young People' recommend that children over five years should eat at least three servings of vegetables and two servings of fruit per day (Ministry of Health, 2012). However, from the '2019/2020 New Zealand Health Survey', only 44.1% of children met the recommended fruit and vegetable intake. Over the last decade there has been a significant reduction in the proportion of children meeting the fruit and vegetable intake guidelines (from 55.5% in 2011/2012). Food preferences of children are often shaped by many modifiable and fixed factors including parental diet quality and habits, frequency of family meals, social norms and attitudes within their environment, media and

advertising, and genetic predisposition (Dresler et al., 2017; Makhal et al., 2020; Scaglioni et al., 2018).

Children's lunchboxes may also be influenced by peer-modelling or perceived social risk. A recent systematic analysis of international qualitative and quantitative studies on the influence of peers on children's healthy eating behaviours showed more often the influence is negative rather than positive, however some studies found no effect at all (Ragelienė & Gronhoj, 2020). Where there were associations, children with friends who were concerned with eating healthy food and were in a scenario where peer attitudes and peer approval were generally positive towards healthy food, had more positive healthy eating behaviours (Bruening et al., 2012; Ragelienė & Gronhoj, 2020). On the other hand, environments where peer models favoured energy-dense foods, and where energy-dense foods were instead perceived as socially acceptable, children were more likely to engage in unhealthy eating behaviours (Fitzgerald et al., 2013; Ragelienė & Gronhoj, 2020; Tarabashkina et al., 2017). Limited data exists in NZ examining the social/peer influence on healthy eating, however, one study in NZ has highlighted that more than a third of surveyed children (n=109) reported social influence from peers and friends affected their food choices (McConnell, 2015). There is a way to make this social situation work in the favour of children. In the Netherlands, a group of researchers recruited the most influential children in each classroom to promote water consumption to their peers (Smit et al., 2016). Children who were exposed to the intervention reported a statistically significant increase in water consumption and a decrease in sugar-sweetened beverage consumption compared to those who did not have the classroom promotion from their peers. Promoting healthy eating through peers and social interaction is a unique opportunity that is missed in health promotion, yet much of the international literature (Bruening et al., 2012; Fitzgerald et al., 2013; Ragelienė & Gronhoj, 2020; Smit et al., 2016; Tarabashkina et al., 2017) highlights that this can both positively and negatively influence dietary intakes in children. More work needs to be done in NZ to examine peer-to-peer interactions on promoting healthy behaviours.

2.3.4.2. Parent factors: Role modelling, knowledge, and affordability

The diets of primary school-aged children is largely dependent on parental dietary intakes, likely due to the lack of autonomy that children at this age have with regard to their dietary choices (Davison et al., 2017). Parental role-modelling, beliefs and attitudes influence children's eating behaviours (Hewitt & Stephens, 2007). Parental diet quality was assessed in relation to children's dietary patterns in Dunedin, NZ (Davison et al., 2017) with results suggesting that if parents had a poorer diet, their children's diet also tended to consist of more frequent consumption of unhealthy foods. Conversely, higher parental diet quality was associated with a lower

consumption of unhealthy snack foods (Davison et al., 2017). Higher frequency of family meals in NZ has also been associated with many positive eating behaviours in children including intake of more fruits and vegetables, eating breakfast before school, and purchasing food less often (Utter et al., 2013; Utter et al., 2008). Parents are often under-utilised in health promotion strategies (Table 2.1). Yet, parents with higher nutritional knowledge and who frequently communicated about healthier eating habits and critical understanding of food advertising led to children consuming less energy-dense foods (Tarabashkina et al., 2017). This highlights parental role-modelling, and parental knowledge and attitudes may be important to target in health promotion. However, these targets are complicated by external influences. For example, parents in NZ of a Pacific Island descent are knowledgeable about healthy foods, however, cost, affordability, and time restraints are more influential on food choices (Teevale et al., 2010). Similarly, Australian parents (Hesketh et al., 2005) and NZ parents (Glover et al., 2019) identified that they did not feel well equipped to choose healthy foods, particularly with increased food marketing, and felt that lifestyle demands, pressure from their children, increased density of food outlets, and peer social influence were barriers to healthy eating.

Although parents may feel that healthy eating is expensive, and cost modelling using NZ data has suggested that compared to current NZ diets, 'healthier' diets are more expensive when matched calorically (Mackay et al., 2018; Vandevijvere et al., 2018c), there is theoretical evidence that substituting current NZ diets for low-cost, nutrient-dense foods can result in healthier and more affordable diets for New Zealanders (Starck et al., 2021). An Australian study looking at lunchbox composition in primary school-aged children found that lunchboxes which contained more fruit juice/cordial, packaged snacks, chocolates, and soft drinks were more expensive to construct compared to a typical lunchbox consisting of one sandwich, two biscuits, a piece of fruit, a packaged snack, and juice/cordial or water (Sanigorski et al., 2005). It was noted that on average the lunches of children in the lowest socioeconomic quartile were 20% more expensive than the lunches of children in the higher socioeconomic quartile, equating to an additional AUD\$52 (US\$40) more per child per year (Sanigorski et al., 2005). Although small, this suggests that changes can be made to improve the healthiness of lunches in lower socioeconomic groups while remaining affordable. Efforts to increase parental awareness and knowledge around healthy eating is needed but cannot be effective in isolation.

Public health policies aim to reduce inequities, particularly for Māori and Pacific peoples and evidence suggests societal biases may be a hindering factor. In a recent analysis of parental views on childhood overweight and obesity across ethnicities in NZ (n=180) (Glover et al., 2019), Pacific participants rejected the idea that "big is seen as beautiful", and the idea that "culture

encourages eating” was deemed offensive to some participants. Respondents also commented on the lack of culturally appropriate information, resources, and services available. Cost of healthy food, relative ease of access of takeaways, and lack of time were the top three perceived factors that influenced a child’s weight (Glover et al., 2019). Affordability of healthy food will always be relative to the amount of income a family receives. Policies that improve affordability and access to healthy food, and that address time-scarcity of people living with food insecurity and those in socioeconomically deprived areas should also be at the forefront of health promotion.

2.3.4.3. School factors: School Leaders and Teachers perceptions

International intervention studies to increase fruit and vegetable consumption in children have shown that teacher attitudes can influence children’s perceptions and contribute to the programme’s success (McDermott et al., 2017; Prelip et al., 2012). Therefore, teachers have an important role in the promotion of healthy eating behaviours. The NZ education curriculum identifies that ‘food and nutrition’ is one of seven key areas of learning within the health and physical activity domain (Ministry of Education, 2015). There is limited data within the NZ context with regards to teachers’ perceptions and attitudes to nutrition promotion within schools. However, the lack of time within the curriculum, which is heavily centred on literacy and numeracy, and the limited nutrition training provided to teachers may be an obstacle (Banville et al., 2017). This is also reported within international literature. Primary school teachers in New South Wales (n=33) (de Vlieger et al., 2019) and primary and secondary school teachers in California (n=102) (Jones & Zidenberg-Cherr, 2015) reported that lack of resources and time were the most common barriers to teaching nutrition. Without an overhaul of the current curriculum, it is likely that external support will be needed to provide teachers with the tools to promote nutrition within the time-scarce teaching environment, similar to interventions such as the *Heart Foundation Heart Start Toi Toi Manawa* programme which delivered curriculum support in NZ for teachers (Table 2.1) (Soupen et al., 2017).

More work needs to be done in NZ to understand the enablers and barriers for teachers to promote a healthy food and drink environment. Some teachers may feel that the school food availability is not their responsibility, however, the types of foods and beverages that dominate a school canteen can undermine the health and nutrition curriculum by promoting unhealthy foods (Drummond & Sheppard, 2011). In an analysis of NZ schools (n=200), 60% of teachers felt that nutrition was high on their list of priorities, yet only half of teachers thought that management supported the provision of healthy foods through the canteen or lunch order service (Carter & Swinburn, 2004). An analysis of Australian school canteens (n=203) found while almost all

canteen managers (92%) reviewed their menus annually to identify opportunities to improve the healthiness of food items sold, less than half labelled their menus to identify healthy options (43%), and less than a quarter had a canteen policy (22%) or included only healthy meals in their 'meal deals' (25%) (Yoong et al., 2015). This may be because canteens need to return a profit. A qualitative analysis of Australian school principals (n=14) and canteen managers (n=14) reported contradictory opinions between the two groups; canteen managers were under the impression that canteens needed to make a profit, versus principals who were not so concerned with profits, and more concerned about what was sold to children (Drummond & Sheppard, 2011). These differing opinions and the wider impact on school food availability highlights the need for comprehensive school food policies.

Additionally, the importance of nutrition promotion in schools may be hindered by differing opinions on whom the responsibility lies with to promote healthy eating in the first place: the school, or the parents. Although many health promotion policies encourage a working relationship between schools and parents, negative parental reactions and parental resistance to changes in food policy have been identified as barriers to implementing a healthy food and drink environment in schools (Walton et al., 2010). Interviews with NZ Principals (n=6) and teachers (n=26) suggested that the primary goal of the school was health education, and that working with families to promote healthy eating behaviours in children was beyond the scope of what was manageable for schools (Clelland et al., 2013). This may tie in with the frustrations felt by teachers with regards to enforcing a food policy in schools given that children have limited control over foods brought to school, and because parents may resent the perceived criticism (Education Review Office, 2017a). School principals are aware that time pressures on parents and food insecurity influence the foods that children bring from home (Walton et al., 2010; Williden et al., 2006), however, many teachers perceive unhealthy foods to be a result of parental lack of nutrition knowledge, skills, and ability (Clelland et al., 2013) which is a concept that adds to the hardship stigma. Policies to improve the school food environment should promote and provide guidance on ways to build a cohesive relationship between schools and the community, both of which have significant influence over children's health behaviours.

2.3.5. Strengths and Limitations

To the author's knowledge, this is the first broad overview of the NZ school food environment. This review included a comprehensive search of the literature using multiple databases to ensure relevant research papers were captured. The food environment was categorised according to the conceptualised four domains; economic, political, availability, and sociocultural, which guided

the scope of this review (Swinburn et al., 1999). There was overlap of the factors within each domain as some factors applied to several categories and, due to the broad examination of the food environment, many connections and interdependencies exist. There are several limitations to this review. A systematic approach to the literature search was not undertaken for the purpose of including the limited available evidence within NZ. Despite this, the review provides the breadth of current evidence on the NZ school food environment, and due to the relatively few NZ studies, evidence from Australian schools was included as the education system and school food guidance is similar. The literature search was guided by co-authors and a librarian to reduce the risk of bias. The search was restricted to English-language publications, and where data from NZ could be obtained pertaining to the four domains and subsections, further literature searches outside of NZ were not conducted to keep within the scope of this paper. Due to the narrow regional scope of this paper, there is the potential that larger international and/or non-English language publications may challenge the conclusions drawn from this review.

2.4. Conclusions

NZ data is lacking with regards to evaluating the effectiveness of school food policies and government guidelines in addressing the school food and beverage environment. Based on existing evidence, school food policies have the potential to improve the healthy food and drink environment, however they are not often implemented and lack comprehensiveness. There are many external influencers that are often not addressed in food policies and guidelines that may hinder implementation. This review highlights the importance of food cost and lack of resources as a significant barrier to implementing a healthy food and drink environment within schools and in the community. Strategies to improve the affordability of healthy foods, particularly in lower socioeconomic areas and those experiencing food deprivation, may help to promote healthy eating in the community and, as a result, positively influence children's food behaviours. Guidelines for improving school food availability should include pricing strategies alongside restriction of unhealthy foods sold in school canteens to incentivise students to make healthier choices. The food environment around schools is also something to explore as part of a health promotion strategy. Policies to restrict unhealthy food advertising and marketing to children should be improved in NZ, particularly around schools. Tools to promote nutrition education in schools should start with added support for teachers to improve their knowledge, confidence, and skills. Using peer-modelling may be an efficient way to promote healthy eating within schools without disrupting the current curriculum. Schools are uniquely placed to promote health and nutrition to children at a critical stage in their lives. They may also play a role in nutrition promotion for the wider community. Greater investment in resources to implement and support

school policies through an external work force may be a viable option to alleviate the pressure from schools. The review highlights gaps in policy implementation, and potential factors that could enable successful implementation of a healthy food environment in NZ schools. Further research on the NZ school food environment, including analyses of current school food availability, food policies, and the implementation of the new 'Healthy Food and Drink Guidance for Schools', would help to identify areas for improvement.

Chapter 3

The effect of healthy food guidance for schools on food availability, purchasing and consumption among school children in New Zealand and Australia: An integrative review

This chapter is an integrative review which addresses Research Question 2: *How effective are national food and drink guidelines on improving the healthiness of school food provision, and what are the barriers and enablers to successful implementation?* The integrative review examines the effect of national guidelines on the nutritional quality of school food offerings and student purchasing behaviours in NZ and Australia and was published in *Nutrition Research Reviews* (Q1, Impact Factor: 6.6, Cite Score: 14) in 2024.

This chapter is based on work conducted and reported as of August 2024, and is presented in its original published form. Citation included below:

Pillay, D., Ali, A., & Wham, C. (2024). The effect of healthy food guidance for schools on food availability, purchasing and consumption among school children in New Zealand and Australia: an integrative review. *Nutrition Research Reviews*, 38(2), 571-585.

3.1. Abstract

Modifying the food environment holds promise for instilling healthier behaviours in children and may be an effective public health strategy for preventing childhood obesity and adverse health outcomes. The school food environment is a valuable setting to influence most children's dietary behaviours from an early age, yet evidence suggests that the New Zealand (NZ) and Australian school food environment is not conducive to healthy food and drink consumption. The present study aimed to investigate the level of compliance in NZ and Australia with government guidelines for food and drink availability within schools and the subsequent effect on food consumption and purchasing behaviours of children. A systematic review utilising three databases; 'PubMed', 'Scopus', and the 'Cochrane Library' was conducted. The research covered peer-reviewed studies from both NZ and Australia that met predefined inclusion criteria. Fifteen studies focussed on assessing food availability within schools based on government guidelines, and ten studies explored food purchasing and consumption by students influenced by changes to the school food environment. Results showed low compliance with government healthy food guidelines for schools, and significant socioeconomic disparities. Western Australia's clear targets as well as the mandatory monitoring systems in place stand out as being a significant enabler of greater compliance with government food policies. Interventions aimed at improving healthy food availability and promoting healthy options in the canteen may positively influence student purchasing and consumption habits. Strategies such as feedback models and incentivisation hold promise for promoting healthier school environments and influencing children's food choices.

3.2. Introduction

Globally, one in six children are classified as overweight or obese (OECD, 2017) with higher rates reported in New Zealand (NZ) and Australia where one in three children in NZ, and one in four children in Australia are classified as overweight or obese (Australian Institute of Health and Welfare, 2024; Ministry of Health, 2021a; OECD, 2017). Habitual dietary intakes and nutrition behaviours developed during childhood and adolescence pave the way for similar behaviours to manifest in adulthood (Ministry of Health, 2012; Movassagh et al., 2017). However early modification in eating behaviours might decrease the risk of obesity and diet related disease. Evidence suggests altering the food environment offers opportunities for children to adopt healthier behaviours and seems to be an effective strategy to prevent childhood obesity (Brug et al., 2017; Sawyer et al., 2021). Given that children spend much of their weekday waking hours at school, alterations to the school food environment may provide an opportunity to improve dietary

behaviours (Carter & Swinburn, 2004). School food provision in NZ and Australia is similar where children may purchase food and beverages during break times (morning tea and lunch) from the school canteen which may be catered for internally by the school or by external food suppliers such as local bakeries, and convenience stores. The majority of schools in NZ and Australia are publicly funded, meaning government school food environment policies have significant potential to improve targeted dietary behaviours (Micha et al., 2018). However, in NZ and Australia, evidence suggests that schools do not encourage healthy food and drink consumption (Carter & Swinburn, 2004), with poor implementation of food policies (Mansoor et al., 2017; Vandevijvere et al., 2018a), unhealthy food and drink availability using canteen profit-models (Billich et al., 2019; Carter & Swinburn, 2004; Wyse et al., 2017), and a time-scarce curriculum with little room for nutrition education (de Vlieger et al., 2019; Rapson et al., 2020). It is therefore unsurprising that children consume more unhealthy foods on school-days compared to non-school-days as a result (Rockell et al., 2011).

Within NZ, previous legislation has sought to improve the food environment in schools. In 2008, all government-funded schools were required to promote healthy food choices and have *only* healthy options available where food and beverages were sold on school premises (Cushman, 2012; Gorton et al., 2009). Despite a 66% uptake of this legislation (Cushman, 2012), following a change in government in 2009 the requirement for *only* healthy food options was removed, placing the onus on the school boards of trustees to mandate healthy food and drinks within schools (Cushman, 2012; Gorton et al., 2009). More recently, NZ schools have used the Food and Beverage Classification System (FBCS) to guide decisions about which foods to provide within schools, with the majority of schools still providing unhealthy food options at cheap prices (Carter & Swinburn, 2004; D'Souza, 2017). The Food and Beverage classification system utilised a three-tier approach classifying foods as 'everyday' (such as sandwiches and vegetables), 'sometimes' (such as pizza and muffins), and 'occasionally' (such as pastry and deep-fried items) (New Zealand Government, 2007).

Superseding the FBCS, the NZ government introduced the 'Healthy Food and Drink Guidance for Schools' in 2020 with the aim to improve the food environment within schools (Ministry of Health, 2020b). This voluntary guidance utilises a traffic-light classification system to categorise foods as 'green', 'amber', or 'red'. Many Australian states have also adopted a state-school mandated traffic-light system with varying recommendations for the degree of 'green', 'amber', and 'red' food availability (Table 3.1) (Rosewarne et al., 2020). Although one of the most effective food-labelling systems to aid consumer understanding of nutrition is the traffic-light system (Borgmeier & Westenhoefer, 2009; Kelly et al., 2009), evidence suggests this does not necessarily translate into

healthy consumer purchasing and consumption behaviours (Borgmeier & Westenhoefer, 2009). Alternatively the 'Healthy Food and Drink Guidance for Schools' suggests increasing the availability of 'green' foods which provide a good source of nutrition such as fruits, vegetables, and wholegrains, limiting 'amber' foods which provide some nutritional value (usually defined with a Health Star Rating >3.5) such as white bread and processed meats, and avoiding 'red' foods which have poor nutritional value such as pastries, confectionary, and sugar-sweetened beverages (Ministry of Health, 2020b). Prediction models suggest that limiting unhealthy foods, and increasing healthy food options to at least 70% of the total menu will result in the majority of children's food purchases (>50%) being healthy (Clinton-McHarg et al., 2018). Previously however, even when NZ schools restricted the availability of foods considered 'sometimes' and 'occasional' foods, these still accounted for a high proportion of total sales (Walton et al., 2010). Since its implementation, only one study has assessed school compliance with the new Ministry of Health 'Healthy Food and Drink Guidance for Schools' in NZ (Pillay et al., 2023b). Similar traffic-light guidance has been implemented in Australia with variable uptake across states and territories despite being mandated in several states (Myers et al., 2019; Silva-Sanigorski et al., 2011; Woods et al., 2014).

Given Australian schools closely resemble the structure of NZ schools with regards to canteen models and school hours, an assessment of the level of implementation of Australian traffic-light school policies may provide useful insights for expected implementation in NZ. A systematic review previously assessed the compliance of healthy canteen policies for Australian schools utilising data up to January 2015 (Lawlis et al., 2016), however, did not assess the implications for food purchasing and consumption by students. Investigating to what extent government school food guidelines are implemented within schools and how this impacts children's food choices can help inform future policy in NZ, particularly around mandating the 'Healthy Food and Drink Guidance for Schools', and/or re-introducing the 'healthy food *only*' clause of the National Administration Guidelines in NZ.

Table 3.1: Food and drink policies in New Zealand and Australia for studies included in this review.

Country/State	Policy Name	Mandated/Voluntary	Policy Type
National: New Zealand	Food and Beverage Classification System (2007-2020)	Voluntary. The board of trustees is required to promote healthy food and nutrition for all students (Ministry of Education, 2020b).	Categorical system (Everyday, Sometimes, Occasionally). Specific policy recommendations were unable to be retrieved as the policy has been superseded.
	NZ Healthy Food and Drink Guidance for Schools (2020)	Voluntary. The board of trustees is required to promote healthy food and nutrition for all students (Ministry of Education, 2020b).	Traffic Light System (Green, Amber, Red). Green items should make up >75% of the menu. Amber items should not dominate the menu. Red items are not available.
National: Australia	National Healthy School Canteen Guidelines (2008)	Mandatory for public schools. Voluntary for independent schools.	Traffic Light System (Green, Amber, Red). Green foods available everyday. Amber foods less prominent on the menu. Red foods not provided.
New South Wales, Australia	NSW Fresh Tastes @ School (2005-2017)	Mandatory for public schools. Voluntary for independent schools.	Traffic Light System (Green, Amber, Red). More than 50% green food items. Amber foods must not dominate the menu. Removal of all red foods.
	NSW Healthy School Canteen Strategy (2017)	Mandatory for public schools. Voluntary for independent schools.	Categorical System (Everyday and Occasional). Everyday foods should make up 75% of the menu. Occasional foods no more than 25%. No sugar-sweetened beverages.
Victoria, Australia	School Canteens and other Food Services Policy Supported by the Go for your life – Healthy Canteen Kit Food Planner (2006)	Mandatory for public schools.	Traffic Light System (Green, Amber, Red, Black). Menus should contain >50% green. Amber foods should not dominate the menu (<50%). Red items should not be included but can be sold on up to two occasions during each of the four school terms. Black items are completely banned.
Western Australia	Western Australia Healthy Food and Drink Policy (2017)	Mandatory for public schools.	Traffic Light System (Green, Amber, Red). Minimum 60% green food items. Maximum 40% amber food items. Red items are not included on the menu.

Abbreviations: NZ, New Zealand; NSW, New South Wales.

3.2.1. Objectives

The aim of this review is to evaluate the effectiveness of government-implemented school food guidance on school food availability, canteen purchasing, and consumption in NZ and Australian primary, intermediate, and secondary schools. The following research questions were developed:

1. Do government-implemented school food guidelines increase the healthiness of the foods available for purchase by students from school canteens, vending machines and/or other outlets within NZ and Australian primary, intermediate, and secondary schools; and what are the enablers and barriers to successful implementation?
2. Does improving the healthiness of foods available to purchase within NZ and Australian primary, intermediate and secondary schools, decrease unhealthy food and drink purchasing and consumption (reduction of sugar-sweetened beverages, and/or reduction of foods high in sugar/fat and/or 'red'/'amber' traffic light food) by students within school hours?

3.3. Methods

3.3.1. Study Design

This study used a systematic approach to retrieve and select relevant literature. A guide to conducting integrative reviews was used to develop and inform the different sections of this review (Toronto & Remington, 2020).

3.3.2. Search Strategy

A search strategy was developed in consultation with the research librarian at Massey University. A comprehensive literature search was conducted on the 2nd February 2024, and updated on the 8th August 2024 with three electronic databases: Scopus, PubMed, and the Cochrane Library, and included published data up to August 2024. An advanced search of all fields including MeSH headings were conducted using the search terms and strings outlined in Table 3.2 and Table 3.3 for each of the respective research questions. All results were exported into Endnote software and duplicates removed using automation, and then manually verified to ensure accuracy. Studies were independently screened by two researchers based on title and abstract. Any discrepancies were resolved through discussion to reach a unanimous decision. Full-text articles were sought for relevant literature. Forward and backward citation screening of the selected studies was used to identify additional studies.

Table 3.2: Search terms and strings used in the integrative review: food availability.

	Kura OR School* OR Primary School* OR Secondary school* OR College* OR Intermediate school* OR Educat*
AND	Polic* OR Intervention* OR Program*OR Promot* OR Guid*
AND	Food* OR Nutri* OR Diet* OR *Drink
AND	Availab* OR Access* OR Provis*
AND	Canteen*OR Menu*OR Food Service* OR Tuckshop* OR Vending OR Outlet* OR Cater*
AND	Australia* OR Zealand*

Table 3.3: Search terms and strings used in the integrative review: food purchasing and consumption.

	Kura OR School* OR Primary School* OR Secondary school* OR College* OR Intermediate school* OR Educat*
AND	Polic* OR Intervention* OR Program*OR Promot* OR Guid*
AND	Food* OR Nutri* OR Diet* OR Drink*
AND	Availab* OR Access* OR Provis* OR Cost* OR Pric*
AND	Canteen* OR Menu* OR Food Service* OR Tuckshop* OR Vending OR Outlet* OR Cater*
AND	Purchas* OR Buy* OR Eat* OR Consum*
AND	Australia* OR Zealand*

3.3.3. Study Selection

For all potentially relevant articles, full texts were retrieved and assessed against the inclusion and exclusion criteria. Studies were considered if they described school food availability and had school food guidelines, policies, or programmes that were in line with government school food policies at the time of publication. Schools were defined as providing primary, intermediate, or secondary education.

For inclusion, schools needed to provide a canteen-based or similar food-purchasing provision system such as tuck-shops, and/or vending machines. When assessing food purchasing and consumption, studies were included if they described student food purchasing or consumption within the school with specific reference to a traffic-light scheme ('red', 'amber', 'green' categorised foods), or a clearly defined categorisation of healthy or unhealthy foods such as 'foods high in sugar', 'foods high in fat', 'sugar-sweetened beverages' (SSB) as per country/state specific guidelines. Studies were restricted to the NZ and Australian context. Studies were excluded if there was no assessment of food and beverage availability, and/or focused only on changes to knowledge/attitudes of key stakeholders within schools. Early childhood education

and tertiary institutions were excluded. Schools provided with free school lunches or those that had described free food provision such as free fruit or charitable donations were excluded due to the reduced control that schools had over the provision of these foods. Review papers (systematic, meta-analyses, narrative) were removed during the screening process; however, the reference lists of relevant review articles were still assessed to identify additional studies pertinent to the present review. There were no restrictions on study design or publication date, only that grey literature was excluded to enhance the strength of the review by utilising peer reviewed publications only. The inclusion criteria limited papers to those published in the English language.

The PRISMA flow diagram (Page et al., 2021) was used to document the number of articles at each stage for the two separate searches regarding food availability, and food purchasing and consumption (Figure 3.1).

3.3.4. Methodological Quality Assessment

The studies included in this review were all assessed for methodological quality using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist (Moola et al., 2020) for cross-sectional analyses, cohort studies, and randomised controlled trials, as deemed appropriate. The risk of bias evaluation was used to help evaluate the quality of evidence from each study but not to exclude any studies from this review. This assessment was undertaken by the primary researcher.

3.3.5. Analysis

Data analysis was conducted by one researcher using a general inductive approach to systematically organise, analyse, and describe the data sets. The process involved familiarisation with the dataset, generating initial codes, and summarising key findings. NVivo version 13 (Lumivvero 2020) software was used to assist in coding and organising the data. Coding was data-driven and guided by the review questions, with initial codes generated based on recurring themes and concepts in the data. These codes were then refined to align with the research objectives. The data was then exported and aggregated manually to find commonalities and differences between the articles. Data was summarised and described in relation to the present research objectives, focusing on key barriers as factors that hinder or restrict effective school food availability and purchasing, and enablers as factors that enhance or support the school food environment.

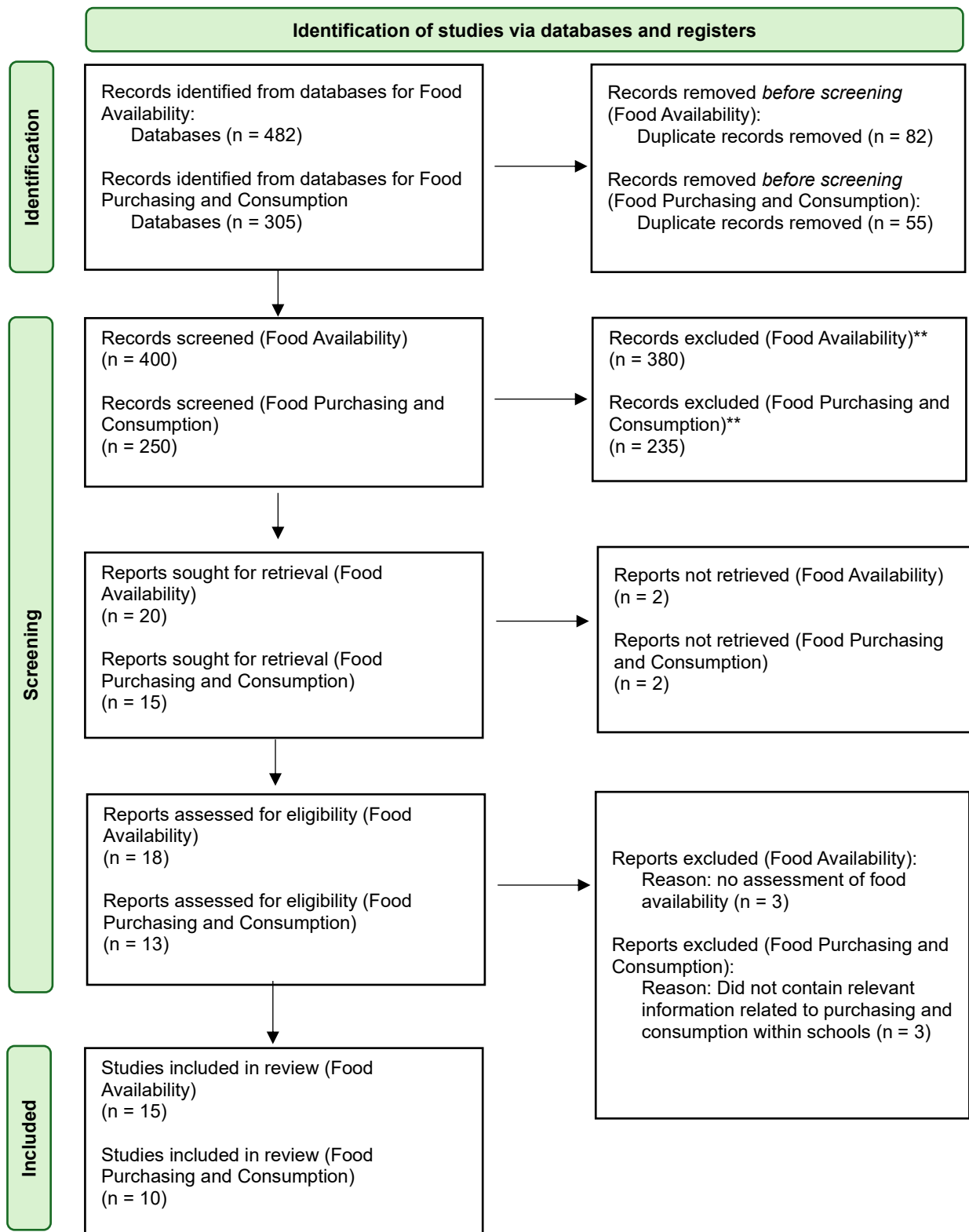


Figure 3.1: PRISMA Flow Diagram for study selection for 1) Food Availability, and 2) Food Purchasing and Consumption in New Zealand and Australian schools

**Records screened based on title and abstract.

3.4. Results

3.4.1. Food Availability within Schools

3.4.1.1. Study Designs and Population

The screening process revealed a significant gap in data on school food availability and compliance with healthy school food guidance in NZ. Most of the studies analysed focused on adherence to Australian school food guidelines (n=13), while only two studies from NZ reported on food availability in schools (Carter & Swinburn, 1999; Pillay et al., 2023b) (Table 3.4). The number of menus analysed varied, with at least 38 schools (Clinton-McHarg et al., 2018) and up to 265 schools at most (Hill et al., 2015). While most studies examined compliance with territory-specific school food guidance, five also proposed interventions to promote healthy food environments within schools. These interventions included multi-component strategies that involved direct audit and feedback models for schools (Nathan et al., 2016; Reilly et al., 2018; Wolfenden et al., 2017; Yoong et al., 2016), as well as incentive schemes such as the *Heart Foundation Heartbeat Award* (Carter & Swinburn, 1999). Dietitians and/or nutritionists were primarily involved in assessing and coding school menus based on the specified criteria of the school food guidance.

3.4.1.2. Study Quality and Risk of Bias

Overall, the quality of the 11 cross-sectional studies were assessed as high, meeting more than 75% of the JBI (Moola et al., 2020) criteria (Appendix 3: Supplementary file 3A), with well-defined methodologies and appropriate analyses. The identification and control for confounding factors was limited among five of the included studies (Carter & Swinburn, 1999; Myers et al., 2019; Pillay et al., 2023b; Reilly et al., 2018; Woods et al., 2014) whereas others employed multivariable regression models for better confounder control. Outcome measurements were consistently clear, assessing compliance with state/country specific healthy food and drink policies. There was only one cohort study assessed as having moderate levels of bias due to lack of clarity around exposure measurements and follow-up (Hill et al., 2015). The three randomised controlled trials were assessed as having low levels of bias (Nathan et al., 2016; Wolfenden et al., 2017; Yoong et al., 2016). Due to the proposed interventions, it was not feasible for schools to be blinded to their 'treatment' arm. School canteen menus were provided by canteen managers which may introduce reporting bias; however, this was done prior to randomisation into control or intervention arms which may have lessened the effect. All menus were analysed by dietitians blind to allocation groups using validated methods to reduce assessment bias.

3.4.1.3. Compliance with Government Healthy Food Guidelines for Schools

Compliance with healthy school food guidelines across all studies was low. On average, 'green' food items represented between 12.1% - 70.0%, 'amber' food items between 28% - 57.7%, and 'red' food items between 2% - 40% based on menu analyses completed by dietitians according to the state/country specific school food policy. NZ schools had the lowest compliance with the healthy food and drink policy with up to 40% of canteen menu items categorised as 'red' food items (Pillay et al., 2023b). In Australia, a recent assessment of Victorian schools found that 94% of school menus still contained a 'red' or 'banned' food item (Hill et al., 2023). Schools in Western Australia had the highest levels of compliance with healthy food and drink policy with 48% of school canteen menus meeting all three traffic-light targets ($\geq 60\%$ 'green' items, $\leq 40\%$ 'amber' items and have no 'red' items) (Myers et al., 2019). Western Australia is the only state to set clear targets on the proportion of menu items that may be offered in each traffic-light category as opposed to qualitative descriptions such as 'majority to be green' (Myers et al., 2019) and this may have led to higher compliance.

Table 3.4: Studies Assessing Food Policies and School Food Availability in New Zealand and Australia

Author	Title	Design	Sample	Intervention	Outcomes
Pillay, <i>et al.</i> 2023 (New Zealand)	Food menus within New Zealand primary school canteens: Do they meet the guidance?	Cross-sectional.	133 primary school menus across NZ collected in 2020 were assessed.	Ministry of Health Food and Drink Guidance for Schools (2020). Voluntary. Traffic-light system.	Most menu items belonged to the less healthy 'amber' (41.0%) and 'red' (40%) food categories. 'Green' food items made up 12.5% of school canteen menus.
Hill, <i>et al.</i> 2023 (Australia)	How healthy and affordable are foods and beverages sold in school canteens? A cross-sectional study comparing menus from Victorian primary schools.	Cross-sectional.	48 primary schools in Victoria, Australia, taken from previous obesity prevention studies provided menus between 2016 and 2019.	School Canteens and Other School Food Services Policy (2006). Mandatory for public schools. Traffic-light system.	21% 'green' food items, 53% 'amber' food items, 25% 'red' food items, and 2% 'black' food items. Overall, 94% of canteen menus included at least one 'red' or 'black' food item.
Haynes, <i>et al.</i> 2021 (Australia)	Secondary school canteens in Australia: analysis of canteen menus from a repeated cross-sectional national survey.	Cross-sectional.	300 participating secondary schools, 244 provided a copy of the canteen menu. From NSW, VIC, QLD, Western Australia, South Australia, Tasmania, Northern Territory, and Australian Capital Territory. Samples taken from the 2012/2013 and 2018 National Secondary Students Diet and Activities surveys.	National Healthy School Canteen Guidelines (2008). Mandatory for public schools. Traffic-light system.	Half of the menus evaluated met the guideline (at least 50% 'green' items). Only one did not have any 'red' items available for purchase. The availability of discretionary product categories declined between 2012-2018, although the only statistically significant reduction was seen in the availability of potato chips from 59.5% to 30.2% (p=0.01).

Reilly, <i>et al.</i> 2021 (Australia)	Secondary school implementation of a healthy eating policy.	Cross-sectional.	53 secondary schools in NSW (25 Catholic schools and 28 Government) provided a copy of the canteen menu. Data was collected between September – November 2017.	NSW Healthy School Canteen Strategy (2017). Mandatory for public schools. Foods classified as ‘everyday’ or ‘occasional’. SSB banned.	Percentage of ‘Everyday items’ on average was 54% (<75% recommended by the policy). No menus met all the criteria for food and beverage classification on menus.
Myers, <i>et al.</i> 2019 (Australia)	Objective assessment of compliance with a state-wide school food-service policy via menu audits.	Cross-sectional.	136 schools in Western Australia (primary and secondary) had a menu available for analysis. Data was collected in September 2017.	WA Healthy Food and Drink Policy (2017). Mandatory for public schools. Traffic light system.	48% of school canteen menus met all three traffic-light targets. Primary school canteens had higher levels of compliance compared to secondary schools.
Reilly, <i>et al.</i> 2018 (Australia)	Scale up of a multi-strategic intervention to increase implementation of a school healthy canteen policy: findings of an intervention trial.	Non-controlled before and after study.	Primary schools located in NSW. 168 schools provided their menu for assessment, follow-up had 157 school menus. Data was collected in February – April 2016 (baseline), and November – December 2016 (follow-up).	NSW Fresh Tastes @ School Healthy Canteen Strategy (2005-2017). Mandatory for public schools. Traffic light system. All schools provided with the intervention. Intervention strategies involved leadership support, consensus processes, education, tools and resources, implementation support, audit and feedback.	35% of schools at follow-up (compared to 17% at baseline) complied with the NSW state policy.
Clinton-McHarg, <i>et al.</i> 2018 (Australia)	Availability of food and beverage items on school canteen menus and association with	Cross-sectional study part of a larger RCT.	38 government primary schools from NSW participated in the study. Data was collected from 2013-2015.	NSW Fresh Tastes @ School Healthy Canteen Strategy (2005-2017). Mandatory for public schools. Traffic light system.	47.9% of canteen items were classified as ‘green’ (less than the 50% requirement), and 4.7% of items classified as ‘red’.

	items purchased by children of primary-school age.				
Wolfenden, <i>et al.</i> 2017 (Australia)	Multi-strategic intervention to enhance implementation of healthy canteen policy: a randomised controlled trial.	Randomised controlled trial.	124 Primary schools in NSW were selected. 70 eligible menus included (35 schools each randomised to either control or intervention arm). Data was collected from April to September 2013 (baseline) and November 2014 to April 2015 (follow-up).	NSW Fresh Tastes @ School Healthy Canteen Strategy (2005-2017). Mandatory for public schools. Traffic light system. Multi-strategic intervention provided to intervention schools: implementation support, executive support, consensus processes, training, tools and resources, monitoring, and feedback. Control schools included.	Intervention schools significantly more likely to have menus without 'red'/'banned' items, and to have at least 50% menu items classified as 'green' foods compared to controls. Purchases made by students were significantly lower in fat in intervention schools.
Nathan, <i>et al.</i> 2016 (Australia)	Effectiveness of a multicomponent intervention to enhance implementation of a healthy canteen policy in Australian primary schools: a randomised controlled trial.	Group randomised controlled trial.	53 primary schools in NSW (28 intervention, 25 control). Data collected in May/June 2014 (baseline) and May/June 2015 (follow-up).	NSW Fresh Tastes @ School Healthy Canteen Strategy (2005-2017). Mandatory for public schools. Traffic light system. The study interventions were informed by Theoretical Domains Framework (TDF) and implemented in intervention schools over 9 months included support, tools, and resources.	Intervention schools more likely to have a menu without 'red'/'banned' food items, and more likely to have at least 50% menu items classified as 'green' compared to control.
Yoong, <i>et al.</i> 2016 (Australia)	CAFE: a multicomponent audit and feedback intervention to	Single-blinded, parallel group randomised	72 primary schools in NSW consented to receiving support (36 school each randomised to control or	NSW Fresh Tastes @ School Healthy Canteen Strategy (2005-2017). Mandatory for	Proportion of schools without 'red'/'banned' items on their menu was not statistically different from the proportion of

	improve implementation of healthy food policy in primary school canteens: a randomised controlled trial.	controlled trial.	intervention arm). Data was collected in February-October 2013 (baseline) and September 2014-January 2015 (follow-up).	public schools. Traffic light system. Intervention schools provided with an audit and feedback strategy to support the implementation of the policy.	control schools. Compared to control schools, intervention schools were more likely to have a lower % of 'red' food items, and higher % of 'green' food items.
Hills, <i>et al.</i> 2015 (Australia)	Improvement in primary school adherence to the NSW Healthy School Canteen Strategy in 2007 and 2010.	Prospective cohort study.	265 primary school menus in NSW were provided for assessment. Data was collected between 2007-2010.	NSW Fresh Tastes @ School Healthy Canteen Strategy (2005-2017). Mandatory for public schools. Traffic light system.	The proportion of schools with no 'red' items increased between 2007-2010. 22% of schools adhered to the guidelines in 2010.
Yoong, <i>et al.</i> 2015 (Australia)	Assessment of the School Nutrition Environment: A Study in Australian Primary School Canteens.	Cross-sectional.	170 primary school menus were obtained in NSW. Data was collected between 2012-2013.	NSW Fresh Tastes @ School Healthy Canteen Strategy (2005-2017). Mandatory for public schools. Traffic light system.	29% of menus consisted of >50% 'green' food items, 25% sold 'banned' drinks. Only 11% of schools had menus that did not contain unhealthy foods.
Woods, <i>et al.</i> 2014 (Australia)	Australian school canteens: menu guideline adherence or avoidance?	Cross-sectional	263 school (primary and secondary) menus sources and assessment from multiple states in Australia. Data was collected between June and August 2012.	Assessed compliance with the state-specific Healthy School Canteen Policy. Mandatory for public schools. Traffic light systems.	Across all schools, 'green' items ranged from being 7-64%, and 'red' items being 0-29% availability.
Silva-Sanigorski, <i>et al.</i> 2011 (Australia)	Government food service policies and guidelines do not create healthy school canteens.	Cross-sectional.	132 schools across Victoria. 106 menus available for analysis. Data was collected in 2008 and 2009.	School Canteens and Other School Food Services Policy (2006). Mandatory for public schools. Traffic-light system.	36.8% of schools included 'banned' items. Government schools were more likely to comply with the policy compared to non-government schools. No school had a menu with >50%

					'green' items as recommended. Only one menu contained no 'red' items. No menu complied with both the SCFS policy and the traffic light-based guidelines.
Carter, <i>et al.</i> 1999 (<i>New Zealand</i>)	Measuring the impact of a school food programme on food sales in New Zealand.	Cross-sectional.	Sample included 232 schools in NZ that had received a Heartbeat Award. 130 operated a canteen, 72 had a lunch ordering service. Data was collected from January 1996 to December 1997.	The Heart Foundations School Food Programme (Heartbeat Award) aligned with the 'Healthy Eating – Healthy Action' strategy (Ministry of Health, 2003a).	The more Heartbeat awards a school had, the more likely they were to report more sales of sandwiches and filled rolls, and fewer sales of doughnuts and cream buns, sausage rolls, chips, and sweets ($R^2=0.76-0.92$).

Abbreviations: NZ, New Zealand; NSW, New South Wales; VIC, Victoria; QLD, Queensland; WA, Wales; RCT, randomised controlled trial; TDF, theoretical domains framework; SCFS, School Canteens and Other Food Services.

3.4.2. Barriers to a Healthy School Canteen

3.4.2.1. Socioeconomic Deprivation

Schools in affluent areas across Australia had lower odds of offering 'red' food items such as sugary drinks, meat pies and other savoury pastries (Haynes et al., 2020). Similarly, logistic regression models found that schools in lower socioeconomic areas in Victoria, Australia were 1.3 times more likely to have 'red' food items on the menu compared to schools in higher socioeconomic areas (Hill et al., 2015). A modest but significantly lower percentage of 'green' food items were also found in NZ schools in areas of high deprivation compared to those in areas of low deprivation (14.2% vs 8.6%) (Pillay et al., 2023b). Although not statistically significant, similar results were reported in New South Wales (NSW) schools where a smaller proportion of schools in disadvantaged areas reported having a menu that primarily consisted of healthier items (Yoong et al., 2015).

3.4.2.2. School characteristics

Medium-sized schools across Australia had lower odds of offering potato chips and other packaged savoury snacks, as well as sugary drinks compared to small schools (Haynes et al., 2020). Similarly, the odds of having a 'red' item on the menu was 1.9 times higher for small schools compared to large schools in Victoria (Hill et al., 2015). Small schools in NZ also provided a lower percentage of 'green' foods (7.1%) and a higher percentage of 'red' foods (61.5%) compared to medium and large schools (Pillay et al., 2023b). The odds of having 'red' food items were higher in non-government schools and rural schools in Victoria (Hill et al., 2015). However, an earlier and similar study in Victoria reported no significant differences in school food menus in government and non-government schools (Silva-Sanigorski et al., 2011). Secondary schools across multiple Australian states were less likely than primary schools to meet the requirements of the healthy food and drink policy, and more likely to offer 'red' food items on their school menus (Myers et al., 2019; Silva-Sanigorski et al., 2011; Woods et al., 2014).

3.4.2.3. Variability in School Guidelines

School-based guidelines and policies regarding the availability of nutritious food options show considerable variation (Clinton-McHarg et al., 2018; Haynes et al., 2020). Some policies prohibit the sale of specific products like soft drinks, while others place limits on the proportion of unhealthy foods, such as deep-fried items (Clinton-McHarg et al., 2018). Recommendations for menu composition also differ, ranging from strict requirements for a majority of 'everyday' options to more flexible guidelines suggesting at least 50% of healthier choices (Haynes et al., 2020). However, all policies agree on not selling 'red' foods and certain energy-dense, nutrient-poor

items like confectionery and sugary drinks. The classification of sugary drinks varied across Australian states, with some definitions encompassing a wider range of beverages (Haynes et al., 2020). Notably, while the healthy food and drink policy for schools is mandated in most states of Australia there is currently no monitoring or consequences in place for schools that fail to uptake and adhere with these guidelines (Nathan et al., 2016).

3.4.3. Enablers of a Healthy School Canteen

3.4.3.1. Improved Availability, Clear Targets, and Monitoring Systems

Limiting the availability of foods and beverages with low nutritional value or increasing the availability of products with high nutritional value, could have a positive impact on child nutrition. General linear models predicted that as the availability of healthier items on a canteen menu increased, so did the purchasing of these items (Clinton-McHarg et al., 2018). It has been suggested that in order for the majority of students to purchase healthier foods, a menu would need to consist of over 70% 'green' items (Clinton-McHarg et al., 2018). Many Australian states have a defined amount of 'green' food items that should be available on the menu ranging from 50% to >75%, yet few define the proportion of 'amber' foods that should follow (Table 3.1).

Western Australia stands out from other states in Australia by setting clear and stringent targets for the proportion of menu items that can be offered in each traffic-light category (Myers et al., 2019). The criteria imposed in Western Australia has shown that having quantifiable targets (>60% 'green' items, <40% 'amber' items, and no red items) led to a greater level of success in compliance with the policy, particularly in primary schools (89% meeting that target) (Myers et al., 2019). Additionally, school principals are mandated to assess canteen menus each year and submit findings to the relevant government department, which has contributed to a high level of compliance. Enforcement is critical for policy adoption, implementation, and subsequent impact (Myers et al., 2019; Nathan et al., 2016). Only two other Australian states, New South Wales and Queensland, had implemented monitoring systems, albeit on a voluntary basis and utilising self-assessment tools (Clinton-McHarg et al., 2018; Haynes et al., 2020), and may explain the lower level of compliance with the subsequent healthy food and drink policies for schools.

3.4.3.2. School Characteristics

The provision and promotion of healthy food and drinks in schools can be influenced by several school characteristics. For instance, larger schools and those situated in affluent areas in NSW and across NZ offered more 'green' food items (Hill et al., 2015; Pillay et al., 2023b; Yoong et al., 2015). However, other studies in NSW, including those by Nathan et al. (2016) and Reilly et al.

(2018), found no significant association between school size and the availability of healthy food. Contrastingly, Haynes et al. (2020) reported that large schools across several Australian states had lower odds of meeting the menu guideline of at least 50% 'green' items compared to small schools. Primary schools in Western Australia were found to have higher compliance with canteen guidelines and were more likely to offer plain milk and fruit than secondary schools (Myers et al., 2019).

Several studies across NSW and Victoria (Reilly et al., 2018; Silva-Sanigorski et al., 2011; Yoong et al., 2015) found that government schools were more likely to have menus that comply with policies than catholic or independent schools. Government schools in NSW were also more likely to prioritise healthy food placement at eye level and implement comprehensive canteen policies whereas non-government schools had lower odds of doing the same (Yoong et al., 2015). Both medium and large schools in NSW were more likely to position healthy foods prominently, with medium schools also implementing comprehensive canteen policies that covered pricing, promotion, and availability of healthy options (Yoong et al., 2015).

3.4.3.3. Feedback Models and Incentivisation

Findings suggest that a multi-strategy intervention which includes training, performance monitoring, feedback, telephone, and text messaging support can improve schools' implementation of healthy canteen policies (Nathan et al., 2016; Reilly et al., 2018). In one study conducted in NSW, this type of intervention was found to be helpful by over 45% of canteen managers surveyed, with menu audit and feedback reports rated as the most helpful component (Wolfenden et al., 2017). Feedback models have the potential to influence school food availability and food sales. In NZ, the introduction of the Heartbeat Award¹ resulted in an increase in sales of sandwiches and filled rolls, and a decrease in sales of doughnuts and cream buns (Carter & Swinburn, 1999). Audit and feedback cycles implemented in several Australian states were shown to be positively associated with a higher proportion of schools having menus without 'red' or 'banned' items, and with menus where more than 50% of items were classified as 'green' compared to schools that did not have any feedback models (Nathan et al., 2016; Reilly et al., 2018; Wolfenden et al., 2017; Yoong et al., 2016). It is likely that more than one contact is needed to maximise the effectiveness of audit and feedback interventions and the use of telephone and

¹ An incentive scheme by the New Zealand Heart Foundation where if schools implemented nutrition policies and a greater selection of healthy food choices for students they could then apply for a 'Heartbeat Award'.

text messaging support can enhance the scalability of the intervention, making it easier to implement on a larger scale.

3.4.4. Food Purchasing and Consumption

3.4.4.1. Study Design and Population

Ten studies were included in the exploration of strategies for enhancing school food environments and promoting healthier food purchasing and consumption (Table 3.5). Eight were conducted in Australia across several states, and two conducted in NZ. One compared traditional and online canteen ordering, evaluating menu characteristics and nutritional content (Leonard et al., 2021), while four studies modified online ordering systems to encourage healthier choices (Delaney et al., 2023; Delaney et al., 2017; Delaney et al., 2022; Wyse et al., 2021). Two studies implemented interventions using policy support, training, and recognition (Sutherland et al., 2022; Wolfenden et al., 2017). Additional studies employed implementation support strategies (Carter & Swinburn, 1999), used image data for assessment (Smith et al., 2019), and conducted telephone interviews and menu audits to understand student purchasing behaviour and improve school food environments (Clinton-McHarg et al., 2018). Study populations differed depending on the aims of the intervention. Those where schools were the focus had a range of n=6-202 schools participating, whereas those where students were the focus had a population of n=158-2714 students.

Table 3.5: Studies Assessing Food Policies and School Food Purchasing in New Zealand and Australia

Author	Title	Design	Sample	Intervention	Outcomes
Delaney, <i>et al.</i> 2023 (Australia)	Exploratory analysis of a cluster randomized controlled trial of a multi-strategy intervention delivered via online canteens on improving the nutritional quality of primary school students' pre-ordered foods & drinks at recess.	Cluster randomised controlled trial.	8 government primary schools in NSW with a total of 485 participants at baseline (aged 5-12 years). Data was collected at baseline (July – September 2016) and follow-up (October - December 2016).	A follow on of the 'Click and Crunch High Schools' intervention which utilises choice architecture through online menu ordering by adding menu labelling, changing the positioning of menu items, providing feedback, and prompts. Assessment of total energy, saturated fat, sugar, and sodium content of lunch orders, as well as compliance with the NSW Fresh Tastes @ School Healthy Canteen Strategy (2005-2017). Mandatory for public schools. Traffic light system.	After 2 months, student recess orders in the intervention group were significantly lower in energy, saturated fat, and sodium compared to control. The proportion of 'green' food items purchased increased for students in the intervention group, however there were no significant differences in 'green' food items between intervention and control groups.
Delaney, <i>et al.</i> 2022 (Australia)	The efficacy of a multi-strategy choice architecture intervention on improving the nutritional quality of high school students' lunch purchases from online canteens (Click & Crunch High Schools): a cluster	Cluster randomised controlled trial.	9 secondary schools in NSW (6 independent, 3 government) with a total of 1331 students at baseline and 999 students at follow-up. Baseline data was collected between October – December 2020. Follow-up data	The 'Click and Crunch High Schools' intervention which utilises choice architecture through online menu ordering by adding menu labelling, changing the positioning of menu items, providing feedback, and prompts. Assessed against the NSW Healthy School Canteen Policy (2017).	After 2 months, there was a significant increase in 'Everyday' items (5.5%) and a reduction in 'Should not be sold' items (4.4%) per student in the intervention arm compared to the control arm. No differences were observed for energy, sugar, and sodium consumption.

	randomized controlled trial.		collected from February – April 2021.		
Sutherland, <i>et al.</i> 2022 (Australia)	A cluster randomised controlled trial of a secondary school intervention to reduce intake of sugar-sweetened beverages: Mid-intervention impact of switchURsip environmental strategies.	Cluster randomised controlled trial.	6 secondary schools in NSW were included (2 catholic, 4 independent). The study included 862 secondary school students in NSW. Baseline data collected in March/April 2018, and follow-up in June/July 2018.	Intervention targeted SSB availability, placement, promotion, and pricing, as well as increased availability and promotion of water. Control schools continued as normal.	At 3-months mid-intervention, no significant differences were observed for mean daily SSB consumption. Significant effects were observed among girls.
Leonard, <i>et al.</i> 2021 (Australia)	Investigating differences between traditional (paper bag) ordering and online ordering from primary school canteens: a cross-sectional study comparing menu, usage and lunch order characteristics.	Cross-sectional.	A sample of 6 primary schools (3 government, 2 catholic and 1 independent) across NSW were included. Data was collected between May and June 2019.	A cross-sectional analysis of the differences between quantity and nutrition quality of lunch orders placed based on paper menus or online menus. Assessed against the NSW Healthy School Canteen Policy (2017).	No significant differences between quantity of items and cost of orders, or the nutritional quality of orders between the two ordering systems.
Wyse, <i>et al.</i> 2021 (Australia)	Long-term Effectiveness of a Multi-strategy Behavioural Intervention to Increase the Nutritional Quality of Primary School	Cluster randomised controlled trial.	2207 students (aged 5-12 years old) from 17 non-government schools in NSW randomised to receive either a behavioural intervention or control. Assessed over an 8-	Multi-strategy behavioural intervention embedded within an existing online school lunch ordering system. Assessment of total energy, saturated fat, sugar, and sodium content of lunch orders, as well as compliance with the NSW	Orders from intervention schools were lower in energy, saturated fat, but no differences with sugar and sodium. Purchasing of 'everyday' items increased in intervention schools.

	Students' Online Lunch Orders: 18-Month Follow-up of the Click & Crunch Cluster Randomised Controlled Trial.		week period at baseline (May-July 2018) and 18-month follow-up (October-December 2019).	Healthy School Canteen Strategy (2017). Voluntary for independent schools. Foods classified as 'everyday' or 'occasional'. SSB banned.	
Smith, <i>et al.</i> 2019 (New Zealand)	Children's healthy and unhealthy beverage availability, purchase and consumption: A wearable camera study.	Cross-sectional.	168 children (aged 11-14 years old) from 16 randomly selected intermediate schools across the Wellington NZ region. Data was collected during school terms from July 2014 to June 2015.	Each child wore a wearable camera (Autographer) all day for four days, Thursday to Sunday.	Findings suggest that the types of beverages children consume reflect the types of beverages that are made available to them.
Clinton-McHarg, <i>et al.</i> 2018 (Australia)	Availability of food and beverage items on school canteen menus and association with items purchased by children of primary-school age.	Cross-sectional.	38 government primary schools from NSW participated in the study. Data was collected from 2013-2015.	NSW Fresh Tastes @ School Healthy Canteen Strategy (2005-2017). Mandatory for public schools. Traffic light system.	Significant positive relationship between the availability and purchasing of 'green', 'amber', and 'red' foods. Each 1% increase in 'green', 'amber', or 'red' foods led to a 1.21%, 1.35%, and 1.67% increase in purchasing, respectively.
Delaney, <i>et al.</i> 2017 (Australia)	Cluster randomised controlled trial of a consumer behaviour intervention to improve healthy food purchases from online canteens.	Parallel-group, cluster randomised controlled trial.	10 government schools in NSW with an online ordering system were recruited between July-September 2016. All students who placed an order within the two-month period following	Intervention strategies included feedback to improve availability of healthy foods, labelling food items, placement of food items, and prompting. Healthy foods assessed against the NSW Fresh Tastes @ School	Intervention schools had lower energy, saturated fat, and sodium in the lunch orders of students compared to control.

			(October – December 2016) were included. 2714 participants placed an online lunch order (1144 in the intervention group, 1570 in the control group).	Healthy Canteen Strategy (2005-2017). Mandatory for public schools. Traffic light system.	
Wolfenden, <i>et al.</i> 2017 (Australia)	Multi-strategic intervention to enhance implementation of healthy canteen policy: a randomised controlled trial.	Randomised controlled trial.	124 Primary schools in NSW were selected. 70 eligible menus included (35 schools each randomised to either control or intervention arm). Data was collected from April to September 2013 (baseline) and November 2014 to April 2015 (follow-up).	NSW Fresh Tastes @ School Healthy Canteen Strategy (2005-2017). Mandatory for public schools. Traffic light system. Multi-strategic intervention provided to intervention schools: implementation support, executive support, consensus processes, training, tools and resources, monitoring, and feedback. Control schools included.	Intervention schools significantly more likely to have menus without 'red'/'banned' items, and to have at least 50% menu items classified as 'green' foods compared to controls. Purchases made by students were significantly lower in fat in intervention schools.
Carter, <i>et al.</i> 1999 (New Zealand)	Measuring the impact of a school food programme on food sales in New Zealand.	Cross-sectional.	Sample included 232 schools in NZ that had received a Heartbeat Award. 130 operated a canteen, 72 had a lunch ordering service. Data was collected from January 1996 to December 1997.	The Heart Foundations School Food Programme (Heartbeat Award) aligned with the 'Healthy Eating – Healthy Action' strategy (Ministry of Health, 2003a).	The more Heartbeat awards a school had, the more likely they were to report more sales of sandwiches and filled rolls, and fewer sales of doughnuts and cream buns, sausage rolls, chips and sweets.

Abbreviations: NSW, New South Wales; SSB, sugar-sweetened beverages; NZ, New Zealand

3.4.4.2. Study Quality and Risk of Bias

Overall, the quality of the four cross-sectional studies were assessed as high, meeting 75% or more of the JBI criteria (Appendix 3: Supplementary File 3A), with appropriate methodologies and analyses. Identification of confounding factors and controlling for these were limited in two out of the four studies (Carter & Swinburn, 1999; Smith et al., 2019), whereas the other two utilised multivariable regression models for better confounder control (Clinton-McHarg et al., 2018; Smith et al., 2019). There were six randomised controlled trials which were assessed as having low levels of bias (Delaney et al., 2023; Delaney et al., 2017; Delaney et al., 2022; Sutherland et al., 2022; Wolfenden et al., 2017; Wyse et al., 2021). Due to the type of interventions, which ranged from multicomponent feedback models for schools to modifications in online ordering systems, blinding of schools to their assigned 'treatment' arm was not feasible. Three studies used online software capturing student purchases which minimised reporting bias (Delaney et al., 2017; Leonard et al., 2021; Wyse et al., 2021), and four studies assessed purchasing through direct observation (Clinton-McHarg et al., 2018; Leonard et al., 2021; Wolfenden et al., 2017) or wearable cameras (Smith et al., 2019). One study used a validated online survey to assess nutritional intake (Sutherland et al., 2022), and another relied on staff-reported sales data (Carter & Swinburn, 1999) which may have introduced some reporting bias. To reduce assessment bias, all menus were analysed by dietitians who were blinded to the allocation groups and used validated methods.

3.4.5. Factors Influencing Food Purchasing and Consumption

3.4.5.1. Food availability

In a study involving 38 schools in NSW, despite similar access to 'green' and 'amber' food items, 'amber' items were purchased at a significantly higher rate than 'green' items (Clinton-McHarg et al., 2018). General linear models indicated that for students to favour 'green' items (>50% of purchases), the menu should consist of over 70% 'green' items ($R^2=0.66$). Additionally, each 1% increase in 'green', 'amber', or 'red' items led to a 1.21%, 1.35%, and 1.67% increase in purchasing, respectively (Clinton-McHarg et al., 2018). The results suggest that restricting low-nutritional-value items or increasing high-nutritional-value options in a school canteen could significantly impact purchasing behaviours. An analysis where students in NZ used wearable cameras found that the availability of core drinks (water and milk) was 12 times that of non-core drinks (SSBs: sugary carbonated beverages, flavoured milk, fruit juice, or fruit smoothies) on school days and core beverages were more frequently consumed compared to non-core drinks (Smith et al., 2019). Almost all (94.1%) the children's purchases however were for non-core drinks whether within the school or outside the school (Smith et al., 2019).

Contrastingly, in an analysis of online and paper-ordering canteen models in NSW, both systems offered similar proportions of 'everyday', 'occasional', and 'should not be sold' foods: online systems had 68% 'everyday', 17% 'occasional', and 15% 'should not be sold' foods, while paper systems had 67% 'everyday', 18% 'occasional', and 6% 'should not be sold' foods. Despite the online system having a marginally higher percentage of 'should not be sold' foods, there were no significant differences in the types of foods purchased between the two systems (Leonard et al., 2021).

3.4.5.1. Healthy Food Promotion

Promoting healthy foods in canteens may have a positive effect on children's food choices. Decreases in children's consumption of saturated fat and total energy were observed when principles of 'choice architecture' were applied to online school-canteen ordering systems in NSW which included changes to menu labelling (using coloured symbols for 'everyday', 'occasional', and 'caution' or 'green', 'amber', 'red' according to the state-specific food policy), positioning healthier foods more prominently, prompting for healthier food choices, incentives with a reward symbol or text, and providing feedback to users on their choices (Delaney et al., 2023; Delaney et al., 2017; Wyse et al., 2017). During an eight-week analysis of the intervention outcomes, notable differences emerged in the distribution of 'green' and 'red' items between the intervention and control schools (Delaney et al., 2017). Student purchases from the intervention schools displayed a significantly higher proportion of 'green' food items (51.21% compared to 37.93% in control schools) and a markedly lower proportion of 'red' food items (1.21% versus 11.11% in control schools) (Delaney et al., 2017). Despite similar availability in the online school-canteen ordering system, in a subsequent 18-month follow-up of the same intervention, the intervention schools exhibited a 3.8% increase in purchases of 'everyday' items and a corresponding 2.6% decrease in purchases of 'caution' items in contrast to the control schools, with no significant differences in 'occasional' food item purchasing (Wyse et al., 2021).

A similar intervention study in NSW which targeted an in-school canteen model aimed to change the availability and placement of SSB by removing it from eye level and displays, reducing the promotion of SSB, changing the price to make them more expensive compared to 'occasional' and 'everyday' beverages, and increasing the availability and promotion of water found that there were no significant changes to SSB consumption by students after a three-month intervention period (Sutherland et al., 2022). Differences between the online-ordering system and the in-person canteen models could be attributed to consumption and environmental behaviours, particularly peer-influence and personal preferences of students versus an online-ordering model where parents may have more control over foods purchased for the child.

3.4.5.1. School Incentivisation

An evaluation of the Heartbeat Award, which NZ schools could earn if they improved the variety and nutritional value of the food provided within the school canteen, showed that more awards significantly correlated with increased sales of sandwiches and filled rolls (76.7% more), and decreased sales of unhealthy items like doughnuts (28.4% less), pies (46.3% less), crisps (24.7% less), and sweets (26.8% less) (Carter & Swinburn, 1999). Schools participating in the programme over time and achieving subsequent Heartbeat awards reported further reductions in unhealthy food sales and increased sales of healthier options. Overall, the findings suggest that the Heartbeat Award programme in NZ positively impacted children's food consumption by increasing the availability and sales of healthier options while reducing the consumption of unhealthy items.

3.5. Discussion

The aim of this review was to evaluate the effectiveness of government-implemented school food guidance on school food availability, canteen purchasing, and consumption in NZ and Australian primary, intermediate, and secondary schools. Findings revealed a low compliance with healthy school food guidelines across the studies, with few schools fully eliminating 'red'/'banned' food items from school canteens. Contrasting guidelines across different territories meant that there were challenges to policy adherence and varying degrees of restrictions on specific products. However, there was an overall theme across the guidelines to remove 'red' and 'caution' foods altogether, making the healthy choice the only available option. Small schools, which tended to offer more 'red' food items on their menus, may need additional support compared to larger schools that generally have greater resources and capacity to implement healthy canteen initiatives.

Schools may have concerns that canteen profits and school revenue could be impacted by providing more healthy options and less unhealthy options which are more appealing to the demographic (Ronto et al., 2020). However, where canteen revenue was assessed in the present review, there were no significant changes to revenue over time between schools who had improved their school canteen, and those who had not (Delaney et al., 2023; Delaney et al., 2017; Delaney et al., 2022; Wolfenden et al., 2017). This perceived school barrier could be appeased through pricing policies by implementing strategies to subsidise or reduce the cost of healthy menu items and disincentive 'red' food items by marking them up, subsequently encouraging healthier choices (Billich et al., 2019).

The mode of delivery could also play a role in the food choices of children. Online versus in-person canteen models revealed differing outcomes from similar intervention strategies, possibly due to the influence of personal preferences, parental oversight, and peer influences in the school environment. Online canteen ordering systems have the ability to implement promotional strategies, feedback, and incentives, and likely have parental oversight that would not be feasible for in-person models (Delaney et al., 2017; Wyse et al., 2021). Peer modelling and education are potential strategies to work around this. Implementing peer-led campaigns showcasing healthy eating as the social norm could encourage students to opt for healthier choices at school as evidence suggests that children are more likely to engage in either healthy or unhealthy eating behaviours depending on what is favoured in their environment (Ragelienė & Gronhoj, 2020; Smit et al., 2016).

Concerningly, schools in marginalised areas were more likely to offer unhealthy food items on their school canteen menu compared to schools in affluent areas (Haynes et al., 2020; Hill et al., 2015; Pillay et al., 2023b). There is a strong association between neighbourhood deprivation and access to unhealthy food outlets in NZ (Pearce et al., 2007). The density of junk food outlets and unhealthy food advertising around schools might create a challenging environment for school canteens, potentially discouraging the provision of healthy food items (Walton et al., 2009). Additionally, surveys indicate that children in areas of high deprivation are less likely to meet their fruit and vegetable intake targets, and more likely to consume SSBs and takeaways (Ministry of Health, 2020a). This underscores the potential concerns in schools within the most neglected areas regarding the acceptability and familiarity of healthy foods. Addressing these disparities is essential for ensuring equitable access to nutritious food choices and could have the greatest positive impact in underprivileged areas.

Multi-component interventions are crucial given the complexity of implementing effective healthy food and drink policies in school settings. Theoretical frameworks such as the Theoretical Domains Framework (TDF) and the Diffusion of Innovation theory provide a basis for understanding behavioural, contextual, and organisational factors that influence policy implementation. The success of multi-component interventions that integrate leadership support and engagement, staff training and education, provision of tools and resources, and performance monitoring have been shown to improve the implementation of healthy food and drink policies within schools (Nathan et al., 2016; Reilly et al., 2018; Wolfenden et al., 2017). A key commonality among these theoretical frameworks for policy implementation is the use of feedback cycles and audits to support policy adoption and implementation. Addressing multiple

elements, including the provision of necessary tools and human resources for monitoring rather than relying solely on policy implementation, can more effectively overcome barriers to change.

The Heartbeat Award programme in NZ highlighted the effectiveness of a school incentivisation scheme in promoting healthier options and reducing unhealthy consumption. Telephone-based monitoring and feedback systems could serve as a practical tool for ongoing support. Offering opt-in schemes that incentivise schools to participate could also foster a sense of accountability. Awards and recognition for schools that consistently maintain healthier canteen environments could further motivate schools to sustain their efforts. By coupling incentives with monitoring and feedback models, a culture of continuous improvement can be established, leading to lasting changes in school food environments.

3.5.1. Limitations

Several limitations must be considered when interpreting the findings of these studies. Self-selection bias is likely to have played a role in many of the reported studies. Self-report measures are susceptible to social desirability bias, wherein respondents may provide answers they perceive as aligning with the researcher's expectations. As a result, school representatives and canteen managers providing reports on the healthfulness of their school menus and food availability may be more likely to be those who have a greater interest in health and nutrition, and a stronger motivation to follow the policy compared to those who did not participate in the studies.

Although sourcing the menus directly from school websites/online sources may reduce self-reporting and sampling bias, it does then result in restrictions on the types of menus available. For example, not all schools have an online presence or their menu available for download, particularly under-resourced schools. Additionally, online menus may fail to display the full extent of the school menu, additional items for sale on certain days of the week, and seasonal variances in menus, particularly in cross-sectional analyses taking data from one time point. This may provide bias towards a healthier canteen model, particularly if schools are aware that they are being monitored for their compliance of a healthy food and drink policy in that area.

All studies utilised a nutrition professional (either a nutritionist or dietitian) to analyse menus for compliance with a healthy food and drink policy. This is deemed the most appropriate way to accurately analyse a large group of menus. However, without additional information on ingredients, nutrient composition, and cooking methods, many categorisations by the researchers were biased towards a more positive picture of the nutritional quality of canteen menus, particularly for 'inconclusive' menu items which in many circumstances were assigned to a healthier category/rating.

This review demonstrates several key strengths. It employed a systematic and comprehensive review approach which, developed in consultation with a research librarian, ensured a thorough examination of the literature. Selection bias was minimised through the independent screening of studies by two researchers which enhanced the reliability of study inclusion. Methodological quality of the included studies were also assessed using validated methods, adding robustness to the evaluation of the evidence. However, this review has several limitations that should be also considered. The search strategy, though comprehensive, was restricted to three electronic databases which might not cover all relevant literature. Additionally, the decision to exclude grey literature might have overlooked valuable insights that are not published in peer-reviewed journals but still relevant to the topic such as PhD/Masters' theses and government-led reports. The exclusion of early childhood and tertiary education institutions may also limit the generalisability of the findings. Due to the limited data available in NZ, and significant contribution of data from Australia, in particular NSW, it is important to acknowledge that findings may not reflect the unique context and challenges faced by schools in NZ.

3.5.2. Future Directions

The generalisability of many of these studies is limited due to the variance in the healthy food and drink policies and small sample sizes. Although, similarities in food provision systems in NZ and Australia are striking, the data suggests that there is a need for more comprehensive NZ-based studies to investigate food availability within schools, compliance with government guidance, and the impact on student purchasing behaviours. Assessing the wider school food provision system may also provide insights particularly for special events, sports days, and field trips where menu deviation may occur. Examining key stakeholder responses and canteen revenue in response to the school canteen policy changes may also yield valuable perspectives on acceptability and future compliance.

3.5.3. Recommendations for Policy and Practice

NZ's limited research on school food environments highlights a need for more studies on this topic. Utilising data from Australian research provides valuable insights and strategies that can be applied to the NZ context, helping to improve the implementation and compliance with healthy school food policies. Key recommendations for policy and practice are outlined below:

- Reinstatement of the clause in the National Administration Guideline for “*only* healthy food” to be provided in schools, and mandate healthy food guidelines in schools.
- Adopt stringent guidelines with clear targets for ‘green’, ‘amber’, and ‘red’ foods. Develop guidelines that help schools to strategically phase out unhealthy food items.

- Increase targeted support and resources for schools in marginalised areas to address disparities and ensure equitable access to healthy food options.
- Establish robust monitoring systems for compliance with healthy food policies such as annual or bi-annual reports and menu audits.
- Provide schools with external support to implement healthy food policies including feedback models, training, and resources, as well as support to assess the nutritional quality of foods available, and how to promote healthy foods in school canteens or through online-ordering systems.
- Develop and encourage incentive schemes to motivate schools to comply with new food policies.

3.6. Conclusion

The analysis highlights the complexity of factors influencing school food availability, compliance with guidelines, and strategies to promote healthier food choices. While challenges such as varying guidelines and socioeconomic disparities persist, clear targets, multi-component interventions, and school incentivisation emerge as promising strategies for creating healthier school food environments and influencing students' food purchasing and consumption behaviours.

Chapter 4

Methods

This chapter provides a brief overview of methods used in chapters 5, 6, 7, and 8. Each empirical chapter includes its own methods section tailored to the specific aims of the paper. This chapter aims to collate this information in one place to provide the reader with a clearer understanding of the overall research design before engaging with the individual empirical chapters.

4.1. Healthy Active Learning

Healthy Active Learning (HAL) is a joint government initiative led by Sport New Zealand, the Ministry of Education, and Health New Zealand (previously the Ministry of Health). The initiative was designed to support schools, kura (Māori immersion schools), and early learning services to enhance the wellbeing of children and young people through healthy eating and drinking, and quality physical activity. As part of this initiative, Health NZ provides a health promotion workforce through the National Public Health service, which between 2020/2021 and 2023/2024 implemented targeted nutrition interventions tailored to the specific needs of schools. These interventions included supporting the development of food policies, delivering professional learning and development for teachers, supporting the establishment of school gardens, engaging in strategic planning, and collaborating with boards of trustees and local networks as required.

Massey University was contracted to evaluate the outcomes of the HAL initiative using a longitudinal mixed methods design, which commenced in 2020. This thesis utilises data from the HAL evaluation and sits within the context of the evaluation of the healthiness of school food and drink environments. The following empirical chapters of this PhD focus solely on the primary school food environment. Ethics approval for the evaluation was granted by the Massey University Human Ethics Committee, Northern (NOR 20/07; Appendix 1).

4.2. Data Collection and Analysis

4.2.1. Participants

As part of the HAL outcome evaluation, contact details for all schools and kura in New Zealand (NZ) were obtained via the website 'Education Counts' (Ministry of Education, 2020a). Schools were contacted between July 2020 and February 2021 to provide information about food available to children. Schools were asked to submit menus where available and complete a series of questionnaire items regarding food sold through school canteens, tuck shops, or external providers. This data formed the basis of the first empirical chapter (Chapter 5) which examined school canteen menus during the initial implementation of the Ministry of Health's 'Healthy Food and Drink Guidance for Schools'. A total of 133 primary schools across NZ provided their school canteen menus for the baseline evaluation of HAL. These primary schools were contacted again between October 2023 and January 2024 to provide updated copies of their school canteen menus, providing insights into the impact of the 'Healthy Food and Drink Guidance for Schools'

over a 3-year implementation period. A total of 89 primary schools provided an updated copy of their school canteen menu which was presented in a longitudinal analysis in Chapter 6.

Additionally, all school principals were contacted in 2020/2021 and again in 2022/2023 to complete a Food Policies and Practices survey as part of the design of HAL evaluation. Phase 1 schools (2020/2021) were contacted at baseline, and Phase 2 schools (2022/23) contacted two years later. Due to recruitment challenges, funding, and the COVID-19 pandemic, these two phases were combined and both were considered to be 'baseline data' for the HAL evaluation. Neither Phase 1 or Phase 2 schools received any support from nutrition advisors prior to data collection. Across the two phased data collection periods, a total of 239 primary schools independently completed the survey. These primary schools were subsequently contacted to provide copies of their school canteen menus, resulting in 80 menus that were analysed and presented in Chapter 7. This chapter explores the relationship between food policies and nutritional quality of food offered through school canteens. To gain an understanding of the wider school food environment, the sample of primary schools that provided canteen menus and completed the Food Policies and Practices survey (n=80) were geospatially analysed in April 2024 using Google's Places API and presented in Chapter 8. This analysis aimed to assess the influence of surrounding food outlets on the presence of school food policies and the nutritional quality of foods offered within school canteens, providing additional context to the previous empirical chapters. An overview of the data collection and participants is outlined in Figure 4.1.

Schools participating in Ka Ora Ka Ako, the free and healthy school lunches programme run by the Ministry of Education, were excluded from the analyses due to significant changes in their food provision systems beyond the control of the school. This programme has been evaluated separately (Peirce et al., 2021).

4.2.2. Food Policies and Practices Survey

School leaders (principals or a member of the senior management team) were invited to complete a brief online survey addressing both healthy food policy and practice within their school environment. The surveys were developed by the Massey University research team in 2020 and updated in 2022 for the second phase of data collection. The policy component of the survey included questionnaire items to determine whether the school had a written healthy food policy, its content, and the operational responsibility. The practice component of the survey explored elements of the food environment including access to water fountains, fundraising activities involving food and beverage companies, external school support programmes, as well as barriers to implementing a healthy school food environment (Appendix 10). Questionnaire items were

adapted from previous national surveys conducted in NZ (D'Souza et al., 2021; Vandevijvere et al., 2019) and Australia (Hardy et al., 2015).

4.2.3. School Food Menus

For this research, a school menu was defined as all foods regularly available for students to purchase at school. Multiple menus offered by a school (e.g. a Subway menu and a local bakery menu or different menus on different days of the week) were combined into one menu for analysis.

4.2.4. Menu Collection

School food menus were collected at baseline (2020/2021) and again three years later (2023/2024) to assess changes in menu composition since the implementation of the 'Healthy Food and Drink Guidance for Schools'. Due to limited overlap in the schools providing school food menus at baseline and those that completed the Food Policies and Practices survey, an additional sample of school food menus was collected in 2023/2024 from survey respondents. This allowed for a comparative analysis between the presence of healthy food policies and their implementation within school canteens.

4.2.5. Menu Analysis Toolkit

To analyse the school canteen menus, three nutritionists and a dietitian developed a Menu Analysis Toolkit to assess all school canteen menus collected as part of the HAL evaluation (Appendix 8). The toolkit provided a breakdown of commonly available package foods and main menu items, categorised using the 'Healthy Food and Drink Guidance for Schools' traffic-light system which classifies foods as 'green' (nutrient-rich), 'amber' (moderate nutritional value), or 'red' (low nutritional value, higher in saturated fat, salt, or sugar). A quick menu analysis was selected as the most suitable method due to its use of defined assumptions, which mitigated variability across menus and between researchers. Compared to comprehensive audits requiring detailed recipe data from sources, quick audits have been shown to be more reliable, cost-effective, and time-efficient (Reilly et al., 2016).

Food providers were grouped into four categories which included main providers (e.g. Libelle Group, Dee Jays, Go Deli), chain providers (e.g. Subway, Pita Pit, Hells Pizza), local providers (e.g. sushi, bakery, or cafes), and in-house catering. Main providers were contacted directly for additional information and where unavailable, standard reference recipes from Woolworths (previously Countdown) supermarkets, or the Edmonds Cookery Book were used to classify meals. Nutrition information for chain providers was sourced from company websites (e.g. Subway, Hells Pizza, Pita Pit). For menus which included a 'create-your-own' component, an

average was defined to categorise these items. For example, an average sandwich was assumed to have three vegetables, one sauce, one bread, and one protein (which may or may not have been specified on the menu). Local providers comprised mainly of bakeries, sushi, and local supermarkets. Portion sizes for local providers were based on commercial standards and were categorised according to the guidance.

Packaged food items were assessed for compliance with the guidance using either manufacturer-reported health star ratings (HSR), or manual calculations using the Ministry of Health HSR calculator excel tool. Where brand or flavour information was missing, a cumulative rating was applied based on at least three or more products within the same category. When labelling 'common menu constituents' for Figures 5.2 and 6.3, ultra-processed foods were defined using the NOVA classification system and included items such as biscuits, chips, crackers, confectionary, and instant noodles (Monteiro et al., 2019) for generalisability for an international audience. Assumptions for ambiguous menu items were resolved through researcher consensus and recorded for consistency (Appendix 9). For the baseline analysis and first use of the Menu Analysis Toolkit, all canteen menus were coded independently by the dietitian/PhD candidate and a second researcher/nutritionist, with 10% of menus swapped and cross-checked to ensure accuracy. The following menu analyses were coded by the dietitian/PhD candidate with 10% of menus cross-checked by a second researcher/dietitian to ensure reliability.

4.2.6. External Food Environment

4.2.6.1. Food outlet data collection

To better understand the external food environment, and the impact of the surrounding food environment on the healthiness of school canteens, the density and types of food outlets around schools were geospatially mapped. This data is presented in Chapter 8. All food outlets within a 1.6-km radius, considered a walkable distance, around the study sample of 80 schools which completed both the Food Policies and Practices survey and provided school canteen menus, were mapped using Google's Places API. Google's Places API is a programmatic interface to Google's database which is used to map registered food outlets based on specific string-terms. Seventeen string-terms were used to find food outlets around schools after multiple iterations of parameter refinement based on categories developed as part of 'Food Environment Score' tool for Australian food environments (Moayyed et al., 2017; Needham et al., 2020), and Google Business categories. These string terms included "Alcohol", "Bakery", "Bar", "Butcher", "Café", "Convenience", "Deli", "Food", "Fruit", "Gas", "Grocery", "Poultry", "Restaurant", "Seafood", "Supermarket", "Takeaway", and "Vegetable". Of the 80 schools, nine did not have any food

outlets within the specified radius, therefore 71 primary schools across NZ were used to collect data from Google's Places API. A total of 6,684 outlets were found through the API.

An interactive map of the study area was generated using the Folium library, a Python tool that allows interactive maps to be created and visualised in a browser. After mapping and visualisation, it was discovered that Google's Places API also included 'relevant' food outlets outside the specified 1.6-km search area, and these were removed leaving a total of 4,176 food outlets for inclusion.

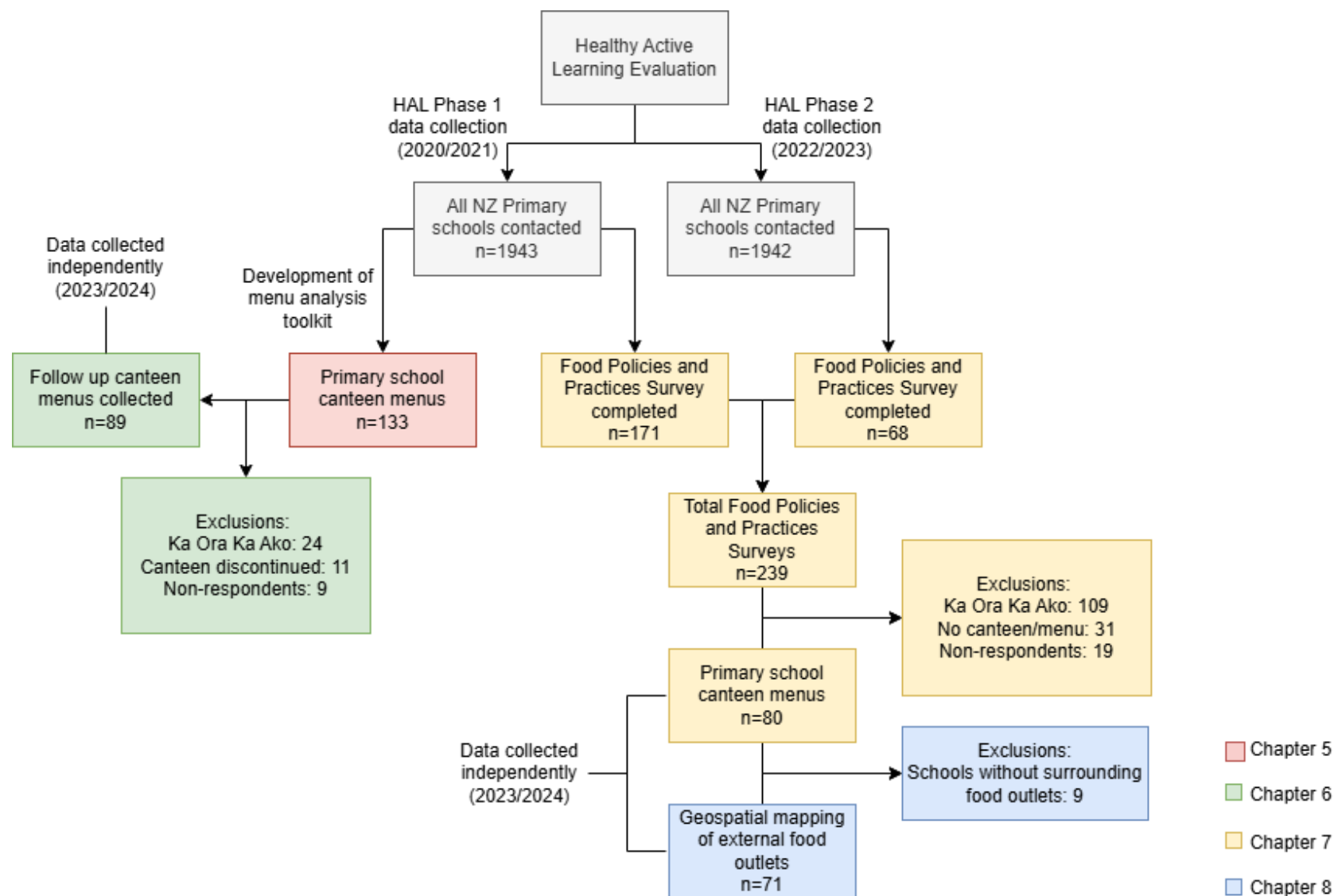


Figure 4.1: Overview of participants through the empirical chapters.

Abbreviations: HAL, healthy active learning.

Definitions: Ka Ora Ka Ako: Free and healthy school lunch programme in New Zealand.

4.2.6.2. Food outlet categorisation

Food outlets were individually and manually characterised according to a 'Food Environment Score' tool (Moayyed et al., 2017; Needham et al., 2020), which was further refined for use in a NZ setting to include liquor/vape shops, and include reference to NZ colloquial terms for outlets such as a 'dairy' which would be considered a 'general/convenience store'. Health scores ranging from -10 to 10 were used to quantitatively assess the healthiness of food outlets with negative numbers corresponding to unhealthy food outlets, and positive numbers indicating healthy food outlets. A health score of 0 was considered neutral and may contain both healthy and unhealthy food options. Several types of outlets were removed manually including online retailers with a registered business address, petrol stations without a general store retailer, catering companies that did not sell food on premise, farming and pet supplies, agriculture supplies, garden centres, and community venues/social clubs. Investigation using Google images, business webpages, Facebook, and other social media were used to categorise ambiguous food outlets such as cafés or restaurants which may also have offered takeaways. Where food outlets were too ambiguous to distinguish, researcher discretion was used. To improve the reliability of the categorisation, 10% of the dataset was independently reviewed by a second and third researcher. An agreement rate above 85% was considered reliable (Cheung & Tai, 2023).

4.2.7. School Characteristics

To provide context for this research, demographic characteristics of participating schools were collected. School characteristics included decile rating, equity index (EQI), geographic area (urban/rural), school type (contributing year 1-6 or full primary year 1-8), school size (based on student roll count), and socioeconomic deprivation using the NZ Deprivation Index (NZDep). School deciles, geographic area, type, and size were sourced from the Ministry of Education's School Directory, while EQI scores were obtained from the Ministry of Education's 'School and Kura EQI Numbers 2023 – 2024' document. The decile system, used from 1995 to 2022, ranked schools from 1 (most deprived) to 10 (least deprived) based on socioeconomic variables, with lower decile schools receiving greater funding. In 2023, the decile system was replaced by the EQI, which incorporates a broader range of factors influencing student learning, beyond residential location (Ministry of Education, 2023). Both measures were included in the empirical chapters to enable comparison with earlier literature.

Socioeconomic deprivation was assessed using the NZDep 2018 for the first empirical paper in Chapter 5 and then updated to the NZDep 2023 for the following empirical chapters. NZDep is an area-based measure derived from census variables, where higher scores indicate greater

deprivation (Environmental Health Intelligence New Zealand, 2023). Decile and NZDep scores were classified as low (1-3), medium (4-6), or high (7-10) in Chapter 5. In Chapters 6, 7 and 8 deciles were characterised as low deprivation (deciles 7-10), medium deprivation (deciles 4-6), and high deprivation (deciles 1-3); and NZDep scores were classified as low deprivation (NZDep 1-3), medium deprivation (NZDep 4-6), or high deprivation (NZDep 7-10) for the ease of the reader following reviewer feedback during the peer-review publication process. EQI scores were initially categorised based on researcher-led cut-offs using low (<399), medium (400-499), and high (>500) in Chapter 5, and was later refined in Chapters 6, 7, and 8 when the Ministry of Education released reporting bands which were characterised as fewer barriers (344-428), moderate barriers (429-494), and more barriers (>495). School size was classified as small (<199 students), medium (200-399), or large (>400).

4.2.8. Statistical Analyses and Data Visualisation

Statistical analyses were conducted using IBM SPSS Statistics version 27 (SPSS Inc., Chicago, IL, USA), with descriptive analyses performed for school characteristics including school type, decile, EQI, school size, geographical area, region, and NZDep score. Normality was assessed using the Shapiro-Wilk and Kolmogorov-Smirnov tests. Where data were non-normally distributed, transformations were applied or non-parametric methods used. Parametric tests included independent t-tests for two-group comparisons and univariate analyses with Tukey's HSD for multiple groups, while non-parametric tests included Mann-Whitney U, Kruskal-Wallis, Wilcoxon Signed-Rank, and McNemar tests, with post-hoc pairwise comparisons or Games-Howell tests applied where appropriate. Chi-square tests were used to examine associations between school characteristics and the presence of food policies, and binary logistic regression assessed whether reported barriers predicted policy presence. Generalised linear models were used to explore relationships between food outlet density and school menu composition. For consistency across the thesis, results were reported as medians [IQR]. All tests were two-tailed with statistical significance defined as $p < 0.05$.

Data visualisation included box plots (Python Seaborn Library) to display median percentages of 'red', 'amber', and 'green' food items by school characteristic, and bar graphs (Excel, Microsoft Office 365) to illustrate food group distribution, menu item categorisation by provider, barriers, and food policy impact. Additionally, a map of external food outlets around the study area was generated using Folium library in Python, enabling interactive visualisation in a web browser. Empirical chapters included a graphical abstract, in line with journal requirements, created using the Canva online design platform.

4.3. Philosophical Framework

This thesis adopts a realist ontological perspective, arguing that the school food environment exists as an objective reality that can be observed and measured independently of the researcher (Crotty, 1998; Guba & Lincoln, 1994; Scotland, 2012). In this view, the healthiness of school canteen menus, food policies and practices, and food outlets surrounding schools are all tangible things that exist in the world and can be examined to understand how they influence children's access to healthy food.

This research takes an objectivist epistemological approach, which implies that knowledge is generated through empirical observation and measurement of observable phenomena, independent of the researchers' values or perspectives (Guba & Lincoln, 1994; Scotland, 2012). This approach is best suited to the research questions as it allows for objective and reproduceable comparison of menu healthiness across schools, assessment of compliance with the Healthy Food and Drink Guidance, and assessment of associations between school characteristics and the healthy food and drink environment.

This research is situated within the post-positivist paradigm, which asserts that while an objective reality exists, our understanding of it is always partial and shaped by the complexity of the context in which the research is conducted (Creswell & Creswell, 2017; Guba & Lincoln, 1994). The choice of this paradigm aligns with the aims of the research as it allows for empirical rigour in measuring and comparing food environments, while acknowledging that findings must be interpreted within the broader social, political, and economic context of school food policy in New Zealand.

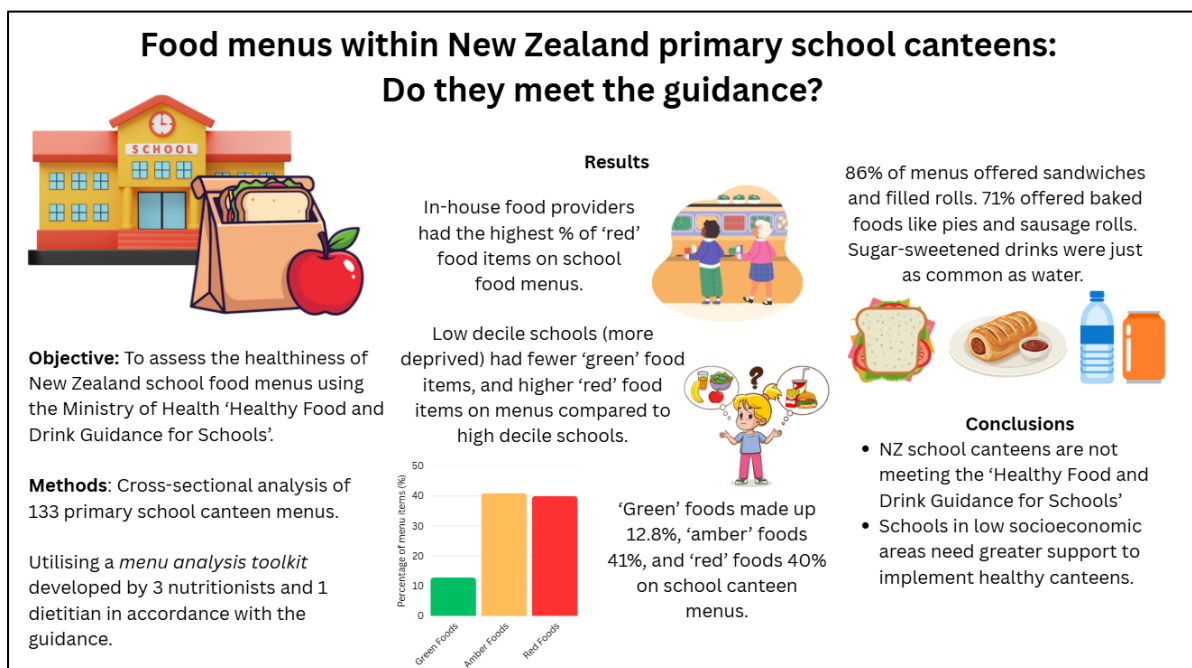
Given the realist ontological, objectivist epistemological, and post-positivist paradigm, this research adopts a mixed observational methodology to explore the healthiness of primary school food environments in New Zealand across multiple socioecological levels including national guidance implementation, school food availability and food practices within schools, and the surrounding food retail landscape. The choice of the narrative and integrative reviews, and cross-sectional and longitudinal study designs align with the belief that a comprehensive understanding of the school food environment requires both contextual synthesis of the existing literature, and empirical measurement of the school food environment.

Chapter 5

Food menus within New Zealand primary school canteens: Do they meet the guidance?

Chapter 5 partially addresses Research Question 3: *To what extent do New Zealand primary school canteen menus meet the national Healthy Food and Drink Guidance for Schools?* through a cross-sectional analysis conducted at the time the guidance was introduced. The study provides the first national assessment of primary school canteen menus using the updated traffic-light classification system and offers a baseline snapshot following the discontinuation of the previous Food and Beverage Classification System. This paper was published in the *Health Promotion Journal of Australia* (Q1, Impact Factor: 1.5, Cite Score: 3.5) in 2023. This chapter is based on work conducted and reported as of July 2023, and is presented in its original published form. Citation included below:

Pillay, D., Piddington, M., Ali, A., Wham, C. (2023). Food menus within New Zealand primary school canteens: Do they meet the guidance? *Health Promotion Journal of Australia*. 35(3), 628-637.



5.1. Abstract

Issue Addressed: Unhealthy food and drinks are widely available in New Zealand (NZ) school canteens. The aim of this study was to assess primary school canteen food menus against the newly implemented Ministry of Health ‘Healthy Food and Drink Guidance for Schools’.

Methods: A convenience sample of 133 primary school canteen menus were collected in 2020 as part of the baseline evaluation of the Healthy Active Learning initiative across NZ. A menu analysis toolkit was developed to assess menus in accordance with the Ministry of Health’s ‘Healthy Food and Drink Guidance for Schools’ which classifies food items into three food categories: ‘green’, ‘amber’, and ‘red’.

Results: Most menu items belonged to the less healthy ‘amber’ (41.0%) and ‘red’ (40%) food categories. Low decile schools had a lower percentage of ‘green’ food items (8.6%) and a higher percentage of ‘red’ food items (48.3%) compared to high decile schools. Sandwiches, filled rolls, and wraps were the most commonly available items followed by baked foods and foods with pastry. Over half of in-house canteen menu items were classified as ‘red’ foods (55.3%).

Conclusions: Most school canteens were not meeting the guidelines for healthy food and drink provision outlined by the Ministry of Health. Improving the food environment for children in socioeconomically deprived areas needs to be prioritised to reduce inequities.

So what? This study highlights the unhealthy food environments in NZ schools and emphasises the need for more robust national policies and mandated school guidance.

5.2. Introduction

Childhood obesity and overweight rates in New Zealand (NZ) are considerably higher than those reported globally (OECD, 2017), with one in three children aged between 2-14 years identified as overweight or obese (Ministry of Health, 2020a). Unhealthy diets, physical inactivity, and childhood obesity have strong links with the development of non-communicable diseases (Sahoo et al., 2015; World Health Organisation, 2013), can negatively influence educational outcomes (Carey et al., 2015; Torrijos-Niño et al., 2014) and have an adverse impact on the psychological wellbeing of children (Russell-Mayhew et al., 2012; Sahoo et al., 2015).

Children's dietary knowledge and food preferences are influenced by various factors, both modifiable and non-modifiable, including the food environment (Makhal et al., 2020; Rath et al., 2016; Scaglioni et al., 2018). Schools are an excellent setting to influence children's dietary behaviours since they have the potential to reach almost all children during the first two decades

of their lives (Ministry of Education, 2000). To create healthier school food environments, the government implemented the Food and Beverage Classification system (FBCS) in 2007 as a tool to classify foods as 'everyday,' 'sometimes,' and 'occasional,' and mandated that *only* healthy food and drinks be provided in schools (Gorton et al., 2009). Due to a change in government in 2009, the responsibility for mandating healthy food and drinks in schools was shifted to the schools' Board of Trustees (Gorton et al., 2009) whose role included planning and acting in the school and community's interests, with a primary focus on student learning, wellbeing, achievement, and progress (Education Review Office, 2017b). While it was expected that schools would improve the healthiness of the foods provided, many schools faced challenges in implementing healthy food and drink policies due to factors such as cost (Pettigrew et al., 2012a; Ronto et al., 2020), time-constraints (Mansoor et al., 2017; Vandevijvere et al., 2018a), and lack of resources (Drummond & Sheppard, 2011; Mansoor et al., 2017). Consequently, there was a gradual shift back to unhealthy foods, as highlighted in a recent analysis of school canteens and food providers using the FBCS, which found that many school menus still offer more 'occasional' food items than 'everyday' items (D'Souza et al., 2021).

Canteen use has been associated with higher consumption of high-fat and high-sugar foods and beverages in NZ primary schools (Carter & Swinburn, 2004; Utter et al., 2007). Previous analyses in NZ has shown that many students buy some or most of their food and drink from the school canteen (Ministry of Health, 2003b), yet, many school canteens and school food providers are not supplying foods that promote healthy eating and nutrition behaviours (Carter & Swinburn, 2004; D'Souza et al., 2021). The Ministry of Health recently implemented the 'Healthy Food and Drink Guidance for Schools' in 2020 which supersedes the FBCS (Ministry of Health, 2020b) (Table 5.1). The new guidance utilises a traffic-light framework, similar to that used in many Australian states (Silva-Sanigorski et al., 2011; VIC Department of Education and Early Childhood Development, 2006; Western Australian Department of Health, 2021), and has been shown to be easier to understand by the general public (Borgmeier & Westenhoefer, 2009; Kelly et al., 2009).

Table 5.1: A summary of the Ministry of Health ‘Healthy Food and Drink Guidance for Schools’*

Green Food Items	Amber Food Items	Red Food Items
• Are a good source of nutrition. • Are the basis of a healthy diet. • Are generally lower in saturated fat, salt, and added sugar. • Are mostly whole and less processed. • Comes from the four food groups: vegetables and fruit; grain foods (mostly wholegrain and those naturally high in fibre); milk and milk products (mostly low fat); and legumes, seafood, eggs and meat with fat removed.	• Are not part of an everyday diet. • May have some nutritional value. • Are often more processed. • In large serving sizes can contribute to consuming excess kilojoules/calories. • In most categories, foods can be defined by a HSR ≥ 3.5 (except for fish and seafood, poultry, and red meat where a HSR < 3.5 is acceptable depending on the portion size).	• Have poor nutritional value. • Are high in saturated fat, salt, and/or added sugars. • Can contribute to consuming excess kilojoules/calories. • Are often highly processed food and drinks. • In most categories, foods can be defined by a HSR < 3.5. Red food items also include sugar-sweetened beverages, confectionary, deep-fried food items, and meals that do not contain any vegetables.

*Descriptions as per the Ministry of Health ‘Healthy Food and Drink Guidance for Schools’ (Ministry of Health, 2020b).

Abbreviations: HSR, Health Star Rating.

NZ's food provision systems present a unique landscape with schools adopting various approaches, including in-house canteens, outsourcing to external companies, or a combination of both. The recent implementation of the traffic-light classification system has allowed closer comparison of NZ and Australian school food provision systems. However, the NZ context stands apart from other countries like the United States, which has a National School Lunch Program providing daily low-cost or free meals to children (USDA Food and Nutrition Service, 2023), or the United Kingdom (Jessiman et al., 2023), Finland (Finnish National Agency for Education, 2023), Sweden (Persson Osowski & Fjellström, 2019), and Japan (Asakura & Sasaki, 2017) operating under a free school lunch model. Meanwhile, countries such as Canada have daily meals provided through organised breakfast and lunch programs and cafeteria services (Critch, 2020).

Previous analyses of school canteens in NZ have either been conducted in specific regions of NZ (Walton et al., 2010), were conducted more than 10 years ago (Carter & Swinburn, 2004; Pledger et al., 2012), or utilise the now out-dated FBCS (D'Souza et al., 2021). This study aims to present data collected in 2020 through the national evaluation of the Healthy Active Learning initiative to

assess the healthiness of NZ school food menus using the Ministry of Health ‘Healthy Food and Drink Guidance for Schools’.

5.3. Methods

5.3.1. Healthy Active Learning Evaluation

The Healthy Active Learning (HAL) initiative is a collaboration between the Ministry of Health, Ministry of Education, and Sport NZ which aims to improve NZ students’ access to quality physical activity and access to healthy food and drinks. Massey University has been contracted to evaluate the outcomes of the HAL initiative. The evaluation is a longitudinal quasi-experimental mixed methods design which began in 2020.

Ethics approval for the Healthy Active Learning evaluation was granted by Massey University Human Ethics Committee, Northern (NOR 20/07).

5.3.2. Data Collection and Participants

All schools in the regions evaluated by HAL were contacted for details about food available to children pre-COVID or during alert level 1². Schools were asked to provide a menu if available and a series of questionnaire items to elicit greater information about food sold to children via the school canteen, tuck shop, or an external food provider between July 2020 and February 2021. Schools signed up to Ka Ora Ka Ako (‘Healthy School Lunches’ programme by the Ministry of Education) were excluded as these schools were likely to have changed their food provision systems as a result (removal of a school canteen and/or change of food provider). This programme has been evaluated separately (Peirce et al., 2021). Responses to food availability were entered into online survey software (Qualtrics, 2015). The school menus collected as part of the HAL evaluation achieved a 5.3% response rate, with 133 out of 2500 primary schools providing their school menus.

To provide context for the study, various characteristics related to the schools were collected. School deciles, area, and size were obtained from the NZ Ministry of Education’s School Directory, while the Equity Index was found on the Ministry of Education’s ‘School and Kura 2023 EQI numbers’ document. Deciles (1-10) were ratings used by the Ministry of Education between 1995 and 2022 to assess how many students within the school lived in low socioeconomic or poorer

² The Alert Levels were determined by the NZ Government and specified the public health and social measures to be taken to fight against COVID-19. Alert Level 1 was the first and least stringent level in a four-level system.

communities. The lower the school's decile rating, the more funding it received. Due to a better understanding of the socio-economic factors that impact student learning, the decile system was replaced with the Equity Index (EQI) in 2023 which utilises a broader range of variables taking into account more than just the residential neighbourhood where students reside (Ministry of Education, 2023). Both measures were included to allow comparison to earlier literature. To determine the schools' deprivation level, the 2018 NZ Deprivation Index (NZDep) was used. The NZDep is an area-based measure of socioeconomic deprivation in NZ based on several census variables where high scores correspond to higher levels of socioeconomic deprivation (Environmental Health Intelligence New Zealand, 2023). School deciles and NZDep scores were classified as low (1-3), medium (4-6), or high (7-10) depending on their respective scores. Equity index was classed as low (≤ 399), medium (400-499), and high (≥ 500). School size was classified as small (≤ 199), medium (200-399), or large (≥ 400) based on the number of students. Due to data collection limitations, the Equity Index and NZDep scores could not be obtained for all schools.

5.3.3. Menu Analysis Toolkit

Four researchers (three nutritionists and one dietitian) developed a 'Menu Analysis Toolkit' to undertake the analysis of all menus collected in the HAL evaluation. The toolkit provides a breakdown of commonly packaged foods and meals/menu items available to purchase within schools. Food providers were categorised as 'main providers' (e.g., Libelle Group, DeeJays, Go Deli), 'chain providers' (e.g. Subway, PitaPit, Hells Pizza, Jesters Pies, Bakers Delights), 'local providers' (sushi, bakery/café, local grocers), and in-house catering. Main providers were contacted by two researchers via email to provide further information and/or a breakdown of composite meals provided on their menus. Where information was not provided, researchers used standard reference recipes sourced from Woolworths Supermarkets to classify the meal. Nutrition information from chain providers was sourced where available from company websites. Commercial sized bakery/café and sushi menu item portion sizes were used when categorising foods from local providers.

In-house catering meals were assessed using standard reference recipes from Woolworths Online Supermarkets (Woolworths New Zealand Limited, 2023) and/or Edmonds Cookery Book (Fielder, 2016). Packaged food items were classified based on their compliance with the guidance with or without the inclusion of either a manual calculation of the Health Star Rating (HSR) or, where available, the manufacturers reported HSR. Where food items did not include a specific brand or flavour e.g., rice crackers, a cumulative rating was given based on available products within that category in NZ. Ultra-processed foods were defined based on the NOVA classification system and included sweet and savoury packaged snack food items such as biscuits, chips,

crackers, confectionary, and instant noodles (Food Standards Australia and New Zealand, 2021). Assumptions were created for menu items requiring additional detail to be categorised according to the guidance through discussion and consensus by all four researchers. Primary school menus were coded by two researchers independently, and 10% of those menus were swapped and rechecked to ensure intercoder reliability.

5.3.4. Statistical Analysis

Statistical analyses were performed using IBM SPSS statistics package version 27 (SPSS Inc., Chicago, IL, USA). Descriptive analyses were completed for school characteristics including school type, deciles, equity index, school size, area, region, and deprivation level.

Shapiro-Wilkes and Kolmogorov-Smirnov tests were used to assess normality. Non-normally distributed data were transformed to obtain normality and parametric tests were used to find significant differences in the percentage of 'red', 'amber', and 'green' food items within each school characteristic. Levene's test was used to assess homogeneity of the data. Univariate analyses were used for characteristics with more than two groups, and Tukey's honest significance difference (HSD) test used to find significances between groups. For characteristics with only two groups, independent t-tests were used. For data that could not be transformed to obtain normal distribution, the Kruskal-Wallis test was used and post-hoc pairwise comparisons or Games-Howell tests were used to determine differences between more than two groups. For non-parametric characteristics with only two groups, the Mann-Whitney U test was used. An alpha value of $P < 0.05$ was considered statistically significant and all tests were two-tailed.

Box plots were created using the Seaborn Statistical Data Visualisation Library available on Python 3.10 (Python Software Foundation) (Python Software Foundation, 2023). School characteristic data is displayed as median (25th and 75th percentile) in box plots for each characteristic according to percentage of 'red', 'amber', and 'green' food items. Bar graphs were created using Excel (Microsoft Office 365) to display percentage of food groups within school menus, and distribution of 'red', 'amber', and 'green' food items according to school food provider.

5.4. Results

5.4.1. Characteristics of New Zealand primary schools

A total of 133 schools provided their school food menus for assessment (Table 5.2). There were more contributing primary schools for years 1-6 (58% of sample), than full primary schools for year 1-8 (42%). Almost half of all schools came from a high decile (7-10) area (46%), whereas only 17% of schools were from a low decile (1-3) area. Most schools had a medium equity index at

59%. In terms of deprivation, almost half of the schools (48%) were in areas with medium deprivation (NZDep 4-7), and almost a quarter (23%) in high deprivation areas (NZDep 7-10). Most schools were located in urban areas, accounting for 77% of the total. School size was similarly distributed, with the majority belonging to the medium-sized school category (38%). There was overlap with school food providers, with some schools having more than one provider. Chain providers and local providers were the most common, supplying food to over half of schools (52% and 53%, respectively), while in-house and school providers supplied fewer schools (20% and 18%, respectively).

5.4.2. Differences in School Menus Based on Demographic Characteristics

In general, most school menus were comprised of ‘amber’ food items (41%), whereas ‘green’ food items were a relatively small portion (12.8%), followed by ‘red’ food items (40%). The median percentages of ‘green’, ‘amber’, and ‘red’ food items within schools according to characteristics such as school type, decile, school size, area, region, deprivation, and equity index are presented in Figure 5.1.

5.4.2.1. School Type

There were no significant differences in the percentage of ‘green’ food items between school type ($p=0.902$). Contributing schools did not significantly differ in their percentage of ‘amber’ food items on school canteen menus compared to full primary schools ($t(131)=0.067$, $p=0.947$). There were no significant differences in the percentage of ‘red’ food items according to school type ($t(131)=0.625$, $p=0.932$).

5.4.2.2. Deciles

‘Green’ food items varied by decile ($H(2)=7.104$, $p=0.029$), with low decile schools providing fewer ‘green’ food items compared to high decile schools (8.6% vs. 15.8%, $p=0.028$). No differences were found in the percentage of ‘green’ food items between low and medium decile schools ($p=0.153$) or between medium and high decile schools ($p=0.150$). No differences were observed in the percentage of ‘amber’ foods across low (38.5%), medium (33.3%), and high (45.2%) deciles ($F(2)=1.527$, $p=0.221$). However, the percentage of ‘red’ food items differed by decile ($F(2)=3.340$, $p=0.039$), with low decile schools providing a higher percentage of ‘red’ food items compared to high decile schools (48.3% and 35.8% respectively, $p=0.036$).

Table 5.2: Characteristics of primary schools that provided food menus relative to all New Zealand primary schools.

		Schools providing food menus (n=133) n(%)	NZ Primary Schools (n=1829) n(%)
School type	Contributing (year 1-6)	77 (58)	771 (42)
	Full primary (year 1-8)	56 (42)	1058 (58)
Deciles [†]	Low (1-3)	23 (17)	569 (31)
	Medium (4-7)	49 (37%)	548 (30%)
	High (8-10)	61 (46%)	698 (38%)
School size	Small	37 (28%)	990 (54%)
	Medium	51 (38%)	506 (28%)
	Large	45 (34%)	333 (18%)
Area	Rural	30 (23%)	605 (33%)
	Urban	103 (77%)	1223 (67%)
Region [‡]	Northland	17 (13%)	105 (6%)
	Auckland	44 (33%)	383 (21%)
	Bay of Plenty	30 (2%)	250 (14%)
	Wellington	23 (17%)	207 (11%)
	Canterbury	18 (15%)	391 (21%)
Equity Index	Low	39 (29%)	-
	Medium	79 (59%)	-
	High	15 (11%)	-
Deprivation	Low (1-3)	38 (29%)	-
	Medium (4-7)	64 (48%)	-
	High (8-10)	31 (23%)	-
Providers [§]	Chain providers	69 (52%)	-
	Local providers	71 (53%)	-
	In-house	26 (20%)	-
	School provider	24 (18%)	-
	Not specified	2 (2%)	-

† Deciles are ratings used by the Ministry of Education to work out funding for schools. A school decile measures how many of its students live in low socio-economic or poorer communities. A school is given a rating between 1 and 10; the lower the school's decile rating, the more funding it receives from the Ministry of Education

‡ Some regions have been combined with others due to a smaller response rate. Bay of Plenty also contains data from the Hawkes Bay, and Canterbury contains Otago/Southland schools.

§ The total percentage of providers is greater 100% due to some schools having more than one food provider. Chain providers include Subway, Pita Pit, St Pierre Sushi, Jesters Pies and other commercial 'chain' operators. Local providers include local bakeries, local sushi, local dairies, and other 'local' food sources. In-house provider is considered food provided by the school itself. School providers include contracted companies such as Go Deli, Dee Jays, and Libelle group food suppliers.

5.4.2.3. School Size

'Green' food items varied by school size ($H(2)=14.736$, $p<0.001$). Small schools provided a lower percentage of 'green' food items (7.1%) than medium (13.5%, $p=0.007$) and large (16.7%, $p=0.001$) schools. No differences were found in the percentage of 'green' food items between medium and large schools ($p=0.478$). 'Amber' food items also differed by school size ($F(2)=5.345$, $p=0.006$), with small schools having a lower percentage of 'amber' food items than medium-sized schools (25.0% vs. 40.0%, $p=0.004$). However, there were no differences in the percentage of 'amber' foods between small and large schools ($p=0.353$), and medium and large schools ($p=0.141$). The percentage of 'red' food items varied by school size ($F(2)=9.629$, $p<0.001$). Small schools had a higher percentage of 'red' food items (61.3%) compared to medium (31.6%, $p<0.001$), and large (39.8%, $p=0.020$) schools. No differences were found in the percentage of 'red' food items between medium and large schools ($p=0.221$).

5.4.2.4. Area

Urban schools provided a higher percentage of 'green' food items (15.1% vs 9.7% in rural schools, $p=0.006$) and lower percentage of 'red' food items (36.90% vs 50.0% in rural schools, $p<0.001$), but had higher proportion of 'amber' food items (43.0% vs 28.0% in rural schools, $p=0.006$) on their menus.

5.4.2.5. Region

Significant regional differences were observed in the percentage of 'green' ($H(4)=12.550$, $p=0.014$), 'amber' ($F(4)=2.704$, $p=0.033$), and 'red' ($F(4)=2.929$, $p=0.023$) food items in school canteens. Auckland schools offered the highest percentage of 'green' food items (20.4%) compared to Northland (11.1%; $p=0.033$), Bay of Plenty (10.4%; $p=0.003$), and Canterbury schools (12.5%; $p=0.035$). Wellington schools had more 'green' food items (20.2%) than Bay of Plenty schools ($p=0.034$). Auckland schools provided a lower percentage of 'amber' food items (32.6%) compared to Wellington schools (46.2%; $p=0.015$). Wellington schools had a lower percentage of 'red' food items (25.8%) compared to Auckland (44.8%; $p=0.037$), Bay of Plenty (41.2%; $p=0.048$), and Canterbury schools (46.9%; $p=0.041$). No other significant differences were found between regions for 'green', 'amber', or 'red' food items.

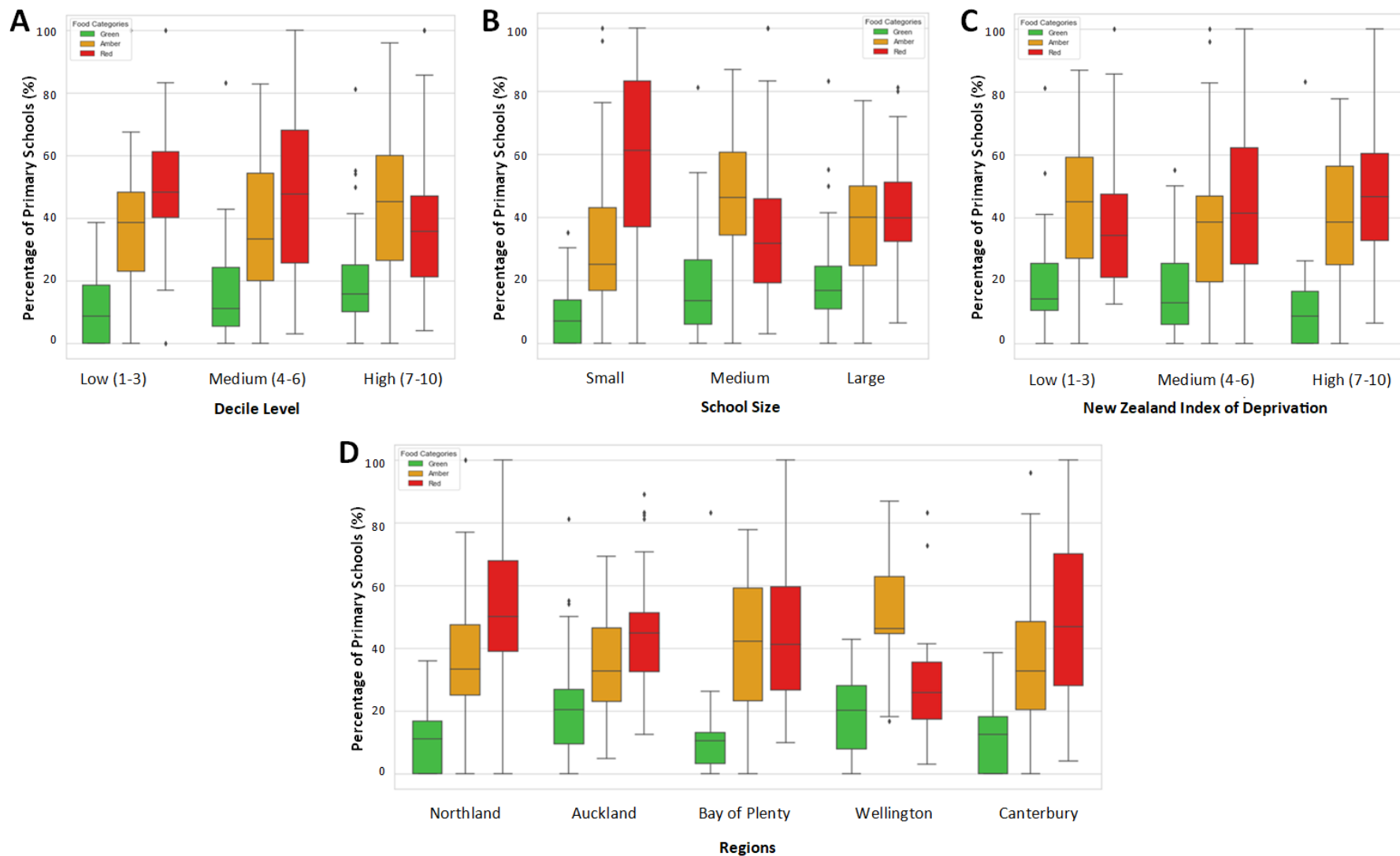


Figure 5.1: Differences in the percentage of 'green', 'amber', and 'red' foods on school menus based on demographic characteristics.

Reported as median [IQR]. Percentages of 'green', 'amber', and 'red' food items according to A: Decile Levels, B: School Size, C: New Zealand Deprivation Index, D: Regions, E: School Type, and F: Area. Definitions: Deciles (1-10) were ratings used by the Ministry of Education between 1995 and 2022. A school decile measures how many of its students live in low socio-economic or poorer communities. The lower the school's decile rating, the more funding it receives. Data aggregation: Regional data was aggregated for areas with low response rates. Due to low response rates from these regions data was aggregated for the following regions: 'Canterbury' includes Otago/Southland schools, and 'Bay of Plenty' includes Hawkes Bay schools.

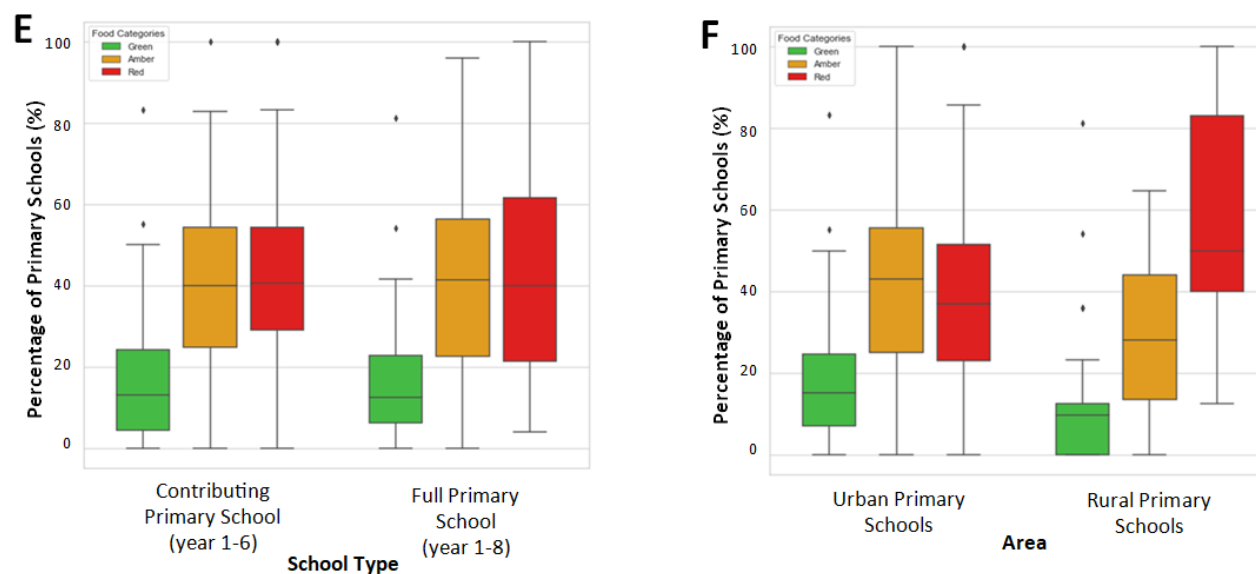


Figure 5.1. continued: Differences in the percentage of 'green', 'amber', and 'red' foods on school menus based on demographic characteristics.

Reported as median [IQR]. Percentages of 'green', 'amber', and 'red' food items according to A: Decile Levels, B: School Size, C: New Zealand Deprivation Index, D: Regions, E: School Type, and F: Area. Definitions: Deciles (1-10) were ratings used by the Ministry of Education between 1995 and 2022. A school decile measures how many of its students live in low socio-economic or poorer communities. The lower the school's decile rating, the more funding it receives. Data aggregation: Regional data was aggregated for areas with low response rates. Due to low response rates from these regions data was aggregated for the following regions: 'Canterbury' includes Otago/Southland schools, and 'Bay of Plenty' includes Hawkes Bay schools.

5.4.2.6. Deprivation

Percentage of 'green' food items varied significantly by deprivation level ($H(2)=6.980$, $p=0.031$). Schools in low deprivation areas had a significantly higher percentage of 'green' food items (14.2%) compared to high deprivation areas (8.6%) ($p=0.031$). No significant differences were found in the percentage of 'amber' and 'red' food items based on deprivation level ($F(2)=0.825$, $p=0.440$ and $F(2)=1.307$, $p=0.276$, respectively).

5.4.2.7. Equity Index

Significant differences in 'green' food items were found between equity levels ($H(2)=17.54$, $p<0.001$). Schools with low equity index had a higher percentage of 'green' food items (22.2%) than medium equity schools (12.1%, $p=0.005$) and high equity schools (6.7%, $p<0.001$). No significant differences were found in percentage of 'amber' and 'red' food items based on equity levels ($F(2)=0.592$, $p=0.555$ and $F(2)=2.471$, $p=0.088$, respectively).

5.4.3. Common Menu Constituents

Figure 5.2 illustrates the most common food and beverage items offered on school food menus. Sandwiches, filled rolls, and wraps were the most common item (86%), followed by baked foods and foods with pastry (including pies and sausage rolls; 71%). Mixed meals containing ultra-processed food items and/or deep-fried items, classified as 'red' food items, were the third most common food items offered (66%). Both ultra-processed sweet and savoury food items were offered by more than half of schools (55% and 56%, respectively). Sugar-sweetened beverages were just as prevalent as water on school food menus (54% each). Sushi and fruit and vegetables, both considered 'green' food items, were offered by less than half of schools (45% and 41%, respectively).

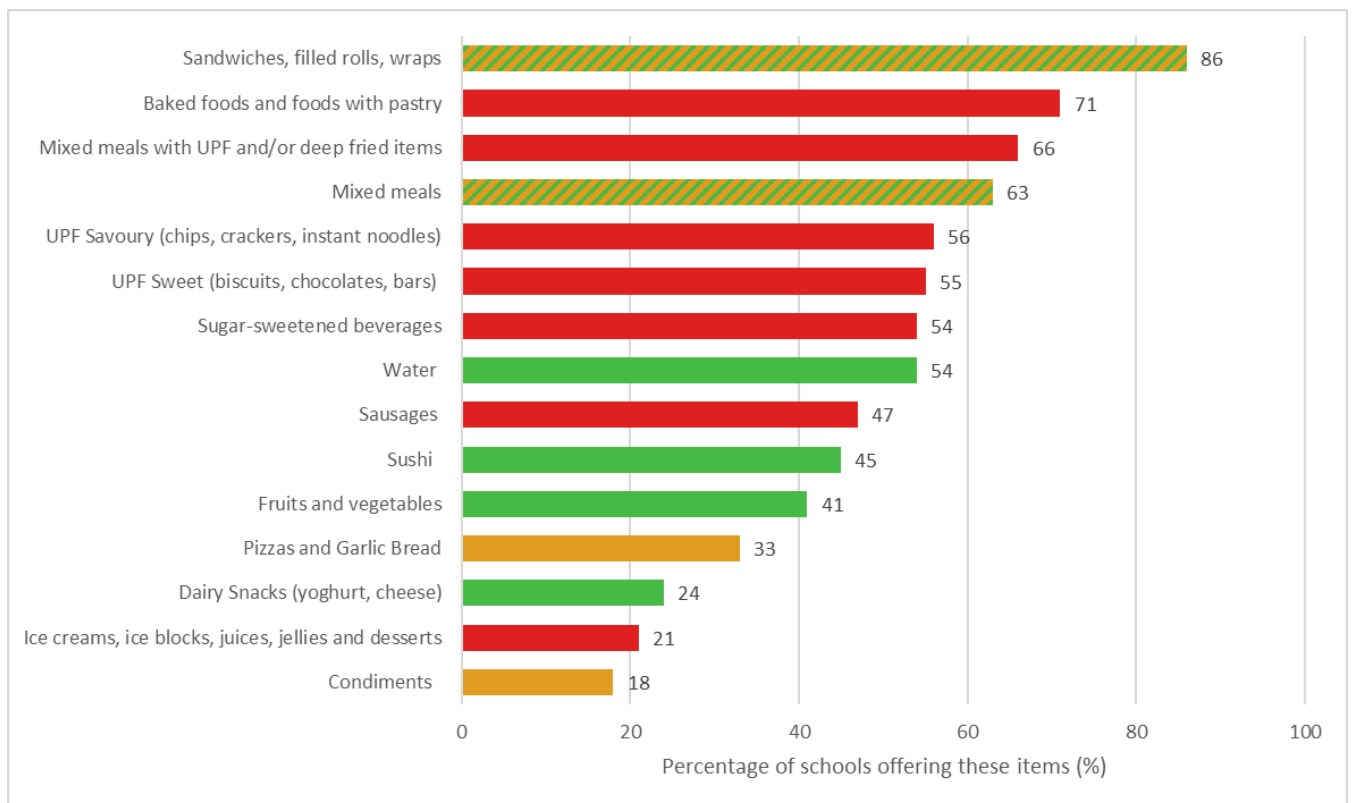


Figure 5.2: Healthiness of the most common menu items available through the school food service according to the Ministry of Health ‘Healthy Food and Drink Guidance for Schools’.

Sandwiches and mixed meals have not been assigned one category due to their split proportion between ‘green’ and ‘amber’ depending on the composition of the meal or sandwich.

Abbreviations: UPF, ultra-processed food.

5.4.4. Healthiness of Foods and Beverages According to Food Providers

Healthiness of foods and beverages offered in schools according to food providers is illustrated in Figure 5.3. There was a similar distribution of ‘green’, ‘amber’, and ‘red’ food items in school menus provided by ‘school providers’ and ‘local providers’, each having 22% and 20.6% ‘green’ food items, respectively, and 44.6% and 43.3% red food items, respectively. In house providers had a low percentage of ‘green’ food items on their menus (8.3%) and a high proportion of ‘red’ food items (55.3%). Chain provider menus were predominantly made up of ‘amber’ food items (52.2%).

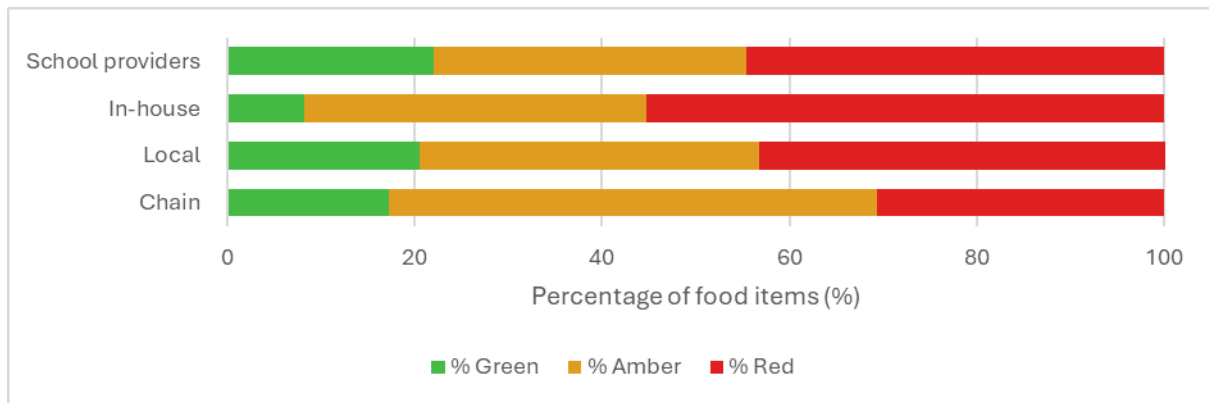


Figure 5.3: Healthiness of foods and beverages offered in schools according to school food providers.

Chain providers include Subway, Pita Pit, St Pierre Sushi, Jesters Pies and other commercial ‘chain’ operators. Local providers include local bakeries, local sushi, local dairies, and other ‘local’ food sources. In-house providers are considered food provided by the school itself. School providers include contracted companies such as Go Deli, Dee Jays, and Libelle group food suppliers.

5.5. Discussion

The current state of foods and drinks offered within school canteens, according to the new ‘Healthy Food and Drink Guidance for Schools’ (Ministry of Health, 2020b), suggests that school canteens are not meeting the Ministry of Health guidance, with the majority of school food and drinks overwhelmingly belonging to either the ‘amber’ or ‘red’ food categories. Although the guidance implemented in 2020 is relatively new to schools, the FBCS has been active since 2007 with the provision of guidelines for healthy school food and drinks within schools (Gorton et al., 2009). Lack of compliance with non-mandated school food guidelines is not a novel finding and has been reported previously in NZ (Carter & Swinburn, 1999; D’Souza et al., 2021) and Australia (Clinton-McHarg et al., 2018; Haynes et al., 2020; Reilly et al., 2021; Silva-Sanigorski et al., 2011; Yoong et al., 2015). The issue of non-compliance may be related to the absence of well-defined targets in government school food guidance (Myers et al., 2019), and the lack of robust monitoring or accountability measures for schools that do not adhere to the guidelines (Nathan et al., 2016). The current study found the most common items offered on canteen menus were sandwiches, filled rolls, and wraps, followed by baked foods and ultra-processed mixed meals. Ultra-processed sweet and savoury food items and sugar-sweetened beverages, considered ‘red’ food items, were also prevalent. Sushi, fruit, and vegetables, considered healthier ‘green’ options, were offered by less than half of the schools. Previous analyses on school compliance with healthy food policies have reported several barriers including lack of time and resources (Drummond & Sheppard, 2011; Ronto et al., 2020), the perceived lack of value (Mansoor et al., 2017; Vandevijvere et al., 2018a), resistance from parents and students (Mansoor et al., 2017;

Vandevijvere et al., 2018a), and the abundance of unhealthy foods for sale outside the school (Walton et al., 2009).

The availability of food items based on various school characteristics have been highlighted in this analysis, in particular the lower percentage of 'green' food items in low decile schools and schools in areas of high deprivation. We observed low decile schools also had a higher percentage of 'red' food items compared to high decile schools. There may be several reasons for these findings including greater access to external food retailers in more deprived areas (Sushil et al., 2017) and higher density of junk-food advertising (Huang et al., 2020; Vandevijvere et al., 2018b) which may disincentivise schools to provide healthy food and drinks within school canteens. Deprivation also plays a role in the nutrition preferences of children with evidence suggesting that household food insecurity often leads to the selection of cheap and unhealthy foods (Carter & Gunasekara, 2012; Ministry of Health, 2019, 2020a). Schools may be concerned about loss of profits (Pettigrew et al., 2012a), limited acceptability of healthier foods by students and parents (Vandevijvere et al., 2018a), and competing interests from external sources (Ronto et al., 2020). Addressing these barriers is an essential part of reducing inequities in schools in socioeconomically deprived areas.

Improving compliance with school food guidelines has been recently explored in some Australian schools and suggests that schools need additional and direct support to successfully implement healthy food and drink policies. For example, in Western Australia, setting clear and quantifiable targets for healthy food options had a positive impact on compliance (Haynes et al., 2020; Myers et al., 2019). Multi-strategy interventions which provide direct support and feedback to schools have also been shown to be effective in promoting healthy eating in schools (Nathan et al., 2016; Reilly et al., 2018; Wolfenden et al., 2017; Yoong et al., 2016). One study found that this type of intervention was helpful to over 45% of surveyed canteen managers, with menu audit and feedback reports rated as the most beneficial (Wolfenden et al., 2017). In NZ, the Heartbeat Award programme led to increased sales of healthy food choices and decreased sales of unhealthy items (Carter & Swinburn, 1999). Audit and feedback cycles were associated with more schools having healthier menus (Nathan et al., 2016; Reilly et al., 2018; Wolfenden et al., 2017; Yoong et al., 2016). Multiple contacts are likely required to maximise effectiveness, and the use of telephone and text messaging support can enhance scalability for larger implementation.

This study presents the first analysis of NZ primary school food menus against the framework of the updated 'Healthy Food and Drink Guidance for Schools' issued by the Ministry of Health. A key advantage of this study is the utilisation of a canteen menu audit which has been recognised

as a reliable means of evaluating canteen compliance with healthy food and drink policies, especially when compared to self-report measures (Reilly et al., 2016). These findings offer a significant baseline snapshot of the current school food availability in NZ presenting opportunities for future comparative analyses that can provide valuable insights to policymakers. Several limitations should be considered when interpreting the findings of this study. Firstly, the response rate from schools was relatively low compared to the total number of primary schools in NZ, which limits the generalisability of the results. Similarly, low decile schools may be under-represented in comparison to high decile schools which may influence some of the differences found. Additionally, as the school menus were self-reported, there is a potential for respondent bias or omission of menus/menu items. Furthermore, some menu items lacked detail, and assumptions had to be made on their final categorisation, which may have influenced the results, particularly for mixed meals and sandwich-based lunch options. Finally, given the differences in school food services internationally, the generalisability of the results may be limited to those with similar food service provisions and policies. Therefore, it is recommended that future studies repeat this research with a larger sample size.

5.6. Conclusion

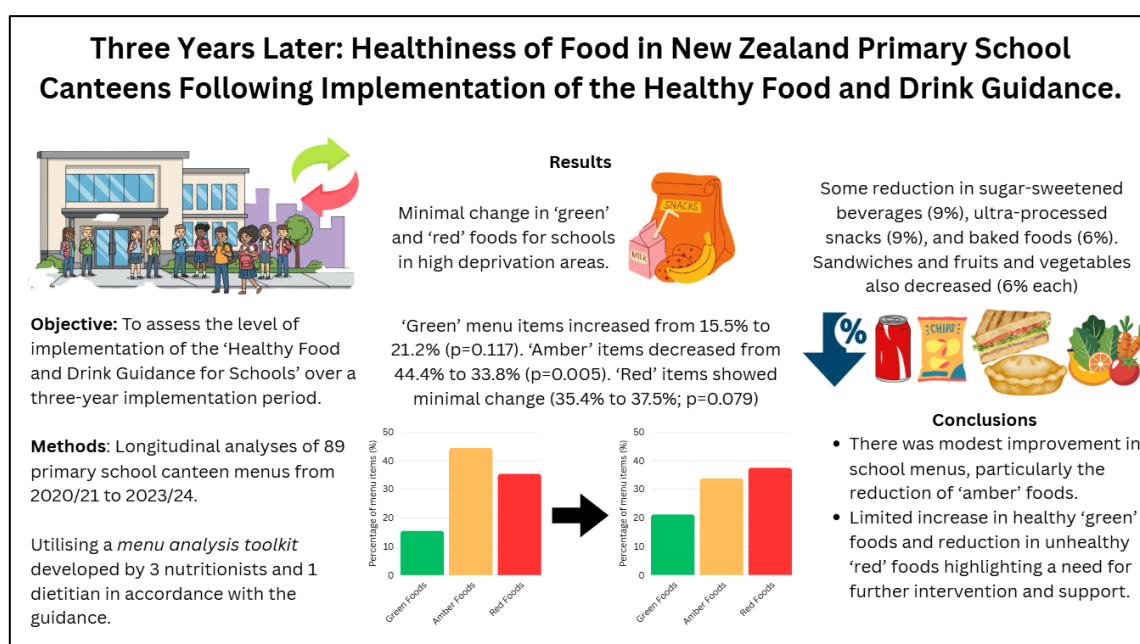
In conclusion, this study revealed that most school canteens in NZ are not meeting the guidelines for healthy food and drink provision outlined in the 'Healthy Food and Drink Guidance for Schools' by the Ministry of Health. This study is one of many highlighting the lack of compliance with government-based school food guidelines and adds to the body of evidence calling for greater action to help schools successfully implement healthy food and drink policies and improve their food provision services. The study also highlighted significant differences in the availability of food items based on various school characteristics, particularly with low decile schools having a lower percentage of 'green' food items and a higher percentage of 'red' food items compared to high decile schools. Addressing these barriers is essential in reducing inequities in socioeconomically deprived areas. One potential approach could be to implement well-defined and measurable targets for healthy food options and multi-faceted interventions that provide active assistance and feedback to schools, which could effectively promote healthy eating in schools.

Chapter 6

Three Years Later: Healthiness of Food in New Zealand Primary School Canteens Following Implementation of the Healthy Food and Drink Guidance.

Chapter 6, in combination with Chapter 5, addresses Research Question 3: *To what extent do New Zealand primary school canteen menus meet the national guidance?* and provides the first national longitudinal analysis of primary school canteen menus using the updated traffic-light classification system in New Zealand. It examines to what extent school canteen menus have changed over a three-year period since the implementation of the Ministry of Health ‘Healthy Food and Drink Guidance for Schools’. This paper was published in the *Health Promotion Journal of Australia* (Q1, Impact Factor: 1.5, Cite Score: 3.5) in 2026. This chapter is based on work conducted and reported as of August 2025, and is presented in its original published form. Citation included below:

Pillay, D., Ali, A., & Wham, C. (2026). Three Years Later: Healthiness of Food in New Zealand Primary School Canteens Following Implementation of the Healthy Food and Drink Guidance. *Health Promotion Journal of Australia*, 37(1), e70135.



6.1. Abstract

Issue Addressed: One-third of children in New Zealand (NZ) are overweight or obese, with suboptimal dietary patterns. The NZ government implemented the Healthy Active Learning initiative and the 'Healthy Food and Drink Guidance for Schools' (2020) to improve school food environments. This study aimed to examine the level of implementation of these guidelines over three years.

Methods: A convenience sample of 89 primary schools (4.6% of NZ primary schools) provided menus at baseline (2020/2021) and follow-up (2023/2024). Food items were categorised according to the guidance using a traffic-light criteria ('green', 'amber', 'red').

Results: 'Green' menu items increased from 15.5% to 21.2%. 'Amber' items decreased from 44.4% to 33.8% ($p=0.005$). 'Red' items showed minimal change (35.4% to 37.5%). There were reductions in the presence of sugar-sweetened beverages (40% to 31%) and ultra-processed savoury snacks (42% to 33%). Schools in affluent areas reduced 'amber' foods, while schools in high deprivation areas saw minimal change in 'green' foods (8.6% to 7.2%) and 'red' foods (32.4% to 29%).

Conclusions: The guidance implementation led to modest improvements in the healthiness of school menus, particularly reducing 'amber' foods and ultra-processed snacks. The limited increase in healthy 'green' foods and persistent presence of unhealthy 'red' foods highlight the need for further intervention.

So what: This study emphasises the importance of sustained efforts to improve the nutritional quality of school food, particularly in communities facing socioeconomic challenges. National consistency, monitoring, and feedback are needed to support policy implementation and ensure children have equitable access to healthy food at school.

6.2. Introduction

One-third of children from birth to fourteen years of age in New Zealand (NZ) are considered to be overweight or obese (Ministry of Health, 2024a). Childhood weight status is likely to carry into adulthood (Simmonds et al., 2016), alongside learned nutrition behaviours (Movassagh et al., 2017). The percentage of children classified as overweight or obese has remained relatively unchanged since 2013 (Ministry of Health, 2024a). This is not surprising, given that children's dietary patterns in NZ are suboptimal with less than half of children achieving the recommended servings of fruits and vegetables per day, and frequent consumption of confectionary and processed meat products (Ministry of Health, 2022). The NZ government has taken initial steps toward improving nutrition and physical activity in schools, primarily through educational

initiatives, voluntary guidelines, and programme-based approaches, with a stronger emphasis on physical activity promotion than on comprehensive nutrition policy (Health New Zealand, 2025; Ministry of Health, 2020b, 2024a; Sport New Zealand, 2022).

In NZ, school attendance is compulsory for those aged between six and 16 years (Ministry of Education, 2000), enabling schools to reach almost all children and adolescents in the first two decades of their lives. There is a significant association between healthy school food environments and reduced rates of childhood obesity (Gray et al., 2019), and it has been recognised that the school food environment plays a crucial role in shaping children's eating habits and overall health. However, research in NZ has highlighted that the school food environment has not been conducive to making healthy choices with a significant proportion of unhealthy foods and drink options available to students (Carter & Swinburn, 2004; D'Souza et al., 2021; Pillay et al., 2023b; Pledger et al., 2012; Vandevijvere et al., 2018a). Recognising this, the NZ government implemented the Healthy Active Learning (HAL) initiative in 2020 jointly through the Ministry of Health, Ministry of Education, and Sport NZ, to promote healthy eating and physical activity in schools, kura³, and early learning services (Health New Zealand, 2025). This was accompanied by the development of the voluntary 'Healthy Food and Drink Guidance for Schools' (Ministry of Health, 2020b).

Previously, a requirement in the National Administration Guidelines (NAG) for *only* healthy food options to be available on school premises was removed in 2009, with the responsibility of which foods provided to be decided by the Board of Trustees, made up of parents and staff (Cushman, 2012; Gorton et al., 2009). The NAG has now been superseded by the 'Education (School Planning and Reporting Regulations) 2023' with a vague mention of food requirements stating "*The board of a school must promote healthy food and nutrition for all of the school's students.*" (Ministry of Education, 2022a, 2024). To assist the creation of healthier food availability in school canteens the 'Healthy Food and Drink Guidance for Schools' (Ministry of Health, 2020b) was implemented in 2020 and utilises a traffic-light system to categorise school food items. 'Green' foods are classified as everyday foods that should be regularly available, 'amber' foods are considered less healthy and should be consumed less frequently, and 'red' foods are considered unhealthy and should not be included on school menus (Table 6.1). Baseline compliance with the guidance was assessed in 2020/2021 among a convenience sample of 133 primary schools in NZ showing that the majority of school canteen menu items belonged to the less healthy 'amber' and unhealthy

³ A school where lessons are typically conducted in Māori

‘red’ food categories, with ‘green’ food items making up a modest 12.5% of menu items (Pillay et al., 2023b).

Table 6.1: A summary of the Ministry of Health ‘Healthy Food and Drink Guidance for Schools’[†]

Green Food Items	Amber Food Items	Red Food Items
• Are a good source of nutrition. • Are the basis of a healthy diet. • Are generally lower in saturated fat, salt, and added sugar. • Are mostly whole and less processed. • Comes from the four food groups: vegetables and fruit; grain foods (mostly wholegrain and those naturally high in fibre); milk and milk products (mostly low fat); and legumes, seafood, eggs, and meat with fat removed.	• Are not part of an everyday diet. • May have some nutritional value. • Are often more processed. • In large serving sizes can contribute to consuming excess kilojoules/calories. • In most categories, foods can be defined by a HSR ≥ 3.5 (except for fish and seafood, poultry, and red meat where a HSR < 3.5 is acceptable depending on the portion size).	• Have poor nutritional value. • Are high in saturated fat, salt, and/or added sugars. • Can contribute to consuming excess kilojoules/calories. • Are often highly processed food and drinks. • In most categories, foods can be defined by a HSR < 3.5. Red food items also include sugar-sweetened beverages, confectionary, deep-fried food items, and meals that do not contain any vegetables.

[†]Descriptions as per the Ministry of Health ‘Healthy Food and Drink Guidance for Schools’ (Ministry of Health, 2020b).

Abbreviations: HSR, Health Star Rating.

There has been variable uptake of similar traffic-light school food policies across Australian schools, with low compliance despite many government school food guidelines being implemented years prior (Hill et al., 2023; Silva-Sanigorski et al., 2011; Yoong et al., 2015). Schools in Western Australia were observed to have higher rates of compliance with school food guidelines which may be attributed to guidelines being mandated, a requirement for annual monitoring reports to be submitted, and clear targets for menu items in each traffic-light category (Myers et al., 2019). In NZ, the ‘Healthy Food and Drink Guidance for Schools’ is voluntary; hence it is important for the uptake of the guidance by schools to be determined.

There is limited longitudinal data, particularly in the NZ context, on the effectiveness of government-implemented guidelines/policies on school canteen menus (Pledger et al., 2012; Silva-Sanigorski et al., 2011). The present study aims to fill this gap by assessing the changes in the nutritional quality of primary school canteen menus over a three-year period following the

introduction of the guidance from 2020/2021 to 2023/2024. By evaluating the presence of ‘green’, ‘amber’, and ‘red’ menu items at baseline and follow-up periods, this study aimed to determine whether the food in NZ primary school canteens became healthier. Insights into the impact of the implementation of the ‘Healthy Food and Drink Guidance for Schools’ will help inform future policy.

6.3. Methods

6.3.1. Healthy Active Learning Evaluation

Healthy Active Learning is a joint government initiative between Sport NZ, the Ministry of Education, the Ministry of Health, and Health NZ that supports schools, kura and early learning services to improve the wellbeing of children and young people through healthy eating and drinking, and quality physical activity and curriculum delivery.

Massey University was contracted to evaluate the outcomes of the HAL initiative. Using a longitudinal quasi-experimental mixed methods design the evaluation began in 2020. Ethics approval for the Healthy Active Learning evaluation was granted by Massey University Human Ethics Committee, Northern (NOR 20/07).

6.3.2. The Nutrition Workforce

Health NZ, previously the Ministry of Health, provided a health promotion nutrition workforce (through the National Public Health Service) to support schools to create healthy food and drink environments. Between 2020/2021 and 2023/2024, the workforce provided practical support including guidance for food policy development, professional learning and development opportunities for teachers, assistance with establishing school gardens, strategic planning, and collaboration with boards of trustees and local networks. The support was provided as needed to empower educators and school communities to implement changes, with the HAL evaluation focusing on the actions and experiences of those within the education settings. To support this work, the ‘Healthy Food and Drink Guidance for Schools’ and associated toolkits were developed (Ministry of Health, 2020b, 2021b). Initial funding through Healthy Active Learning enabled the employment of 15.5 full-time equivalent (FTE) health promotion staff within public health units, along with one national advisor. This was increased to 30.5 FTE after the cessation of a separate Ministry of Health-funded programme. Changes in government and the establishment of Health NZ have resulted in 27 FTE currently in place. Between 2020 and 2022, a substantial portion of the workforce was temporarily reassigned to support the COVID-19 response. Most staff resumed Healthy Active Learning responsibilities from mid-2022.

6.3.3. Data Collection and Participants

All schools were contacted between July 2020 and February 2021 as part of the baseline data collection for the HAL outcome evaluation. A 6.8% response rate for school menus was achieved with 133 out of 1943 primary school providing their school menus. Analyses of these menus have been reported previously (Pillay et al., 2023b). To evaluate menu changes made as part of the HAL initiative the 133 schools were contacted between October 2023 and January 2024 and 89 schools responded with updated menus. There were 24 schools excluded as they engaged with Ka Ora Ka Ako, the free ‘Healthy School Lunches’ programme by the Ministry of Education (Ministry of Education, 2021), 11 had discontinued their school canteen, and 9 did not respond to the follow-up request (Figure 6.1).

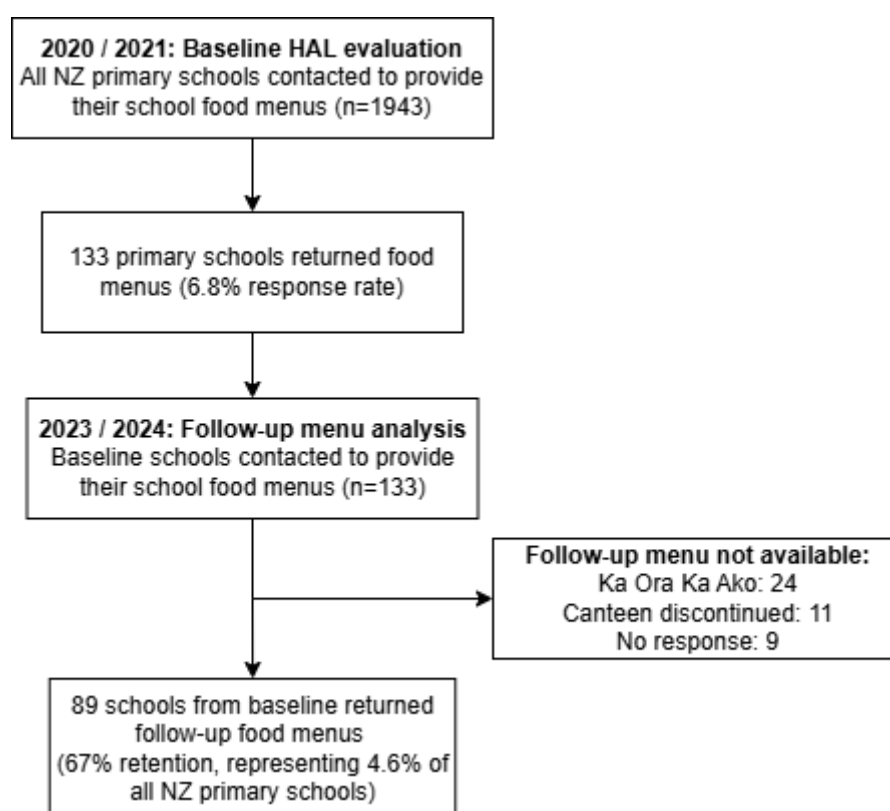


Figure 6.1: Data collection and participants at baseline (2020/2021) and follow-up (2023/2024).

Demographic characteristics of the participating schools were collected. The school deciles, geographic area, and size were sourced from the NZ Ministry of Education’s School Directory and the Equity Index (EQI) was obtained from the Ministry’s ‘School EQI Numbers 2023–2024’ document. The NZ decile school system, used from 1995 to 2022, ranked schools from 1 (most deprived) to 10 (least deprived) based on several socioeconomic variables, with lower decile schools receiving more funding. In 2023, the decile system was replaced by the Equity Index (EQI),

which considers a broader range of socioeconomic factors with higher scores indicating greater need for additional support and funding. For comparative purposes both measures were included. Deciles were described as low deprivation (deciles 8-10), medium deprivation (deciles 4-7), and high deprivation (deciles 1-3). The 2023 NZ Deprivation Index (NZDep), an area-based measure of socioeconomic deprivation, was used to determine schools' deprivation levels. NZDep scores were classified as low deprivation (NZDep 1-3), medium deprivation (NZDep 4-6), or high deprivation (NZDep 7-10). The EQI was categorised using the Ministry of Education 'School Equity Index Bands and Groups' for 2024, which reflect socioeconomic barriers to education: few barriers (344-428), moderate barriers (429-494), and more barriers (>495) (Ministry of Education, 2025). School size was classified as small (≤ 199), medium (200-399), or large (≥ 400) based on student numbers.

6.3.4. Menu Analysis

Four researchers (three nutritionists and one dietitian) developed a menu analysis toolkit to undertake the analysis of all menus collected in the HAL evaluation in 2021. Details of the toolkit, including development and categorisation of food items, have been described elsewhere (Pillay et al., 2023b). Briefly, the toolkit provides a breakdown of commonly packaged foods and meals/main menu items available to purchase within schools and is categorised using a traffic-light system according to the Ministry of Health 'Healthy Food and Drink Guidance for Schools'. The traffic-light system utilises a 'green', 'amber', and 'red' categorisation for school menu items (Table 6.1). Follow-up menus were categorised by the primary researcher/dietitian using the menu analysis toolkit, with 10% of menus cross-checked by a secondary researcher/dietitian to ensure intercoder reliability.

6.3.5. Statistical Analysis

Statistical analyses were performed using IBM SPSS statistics package version 27 (SPSS Inc., Chicago, IL, USA). Descriptive analyses were completed for school characteristics including school type, deciles, equity index, school size, area, region, and deprivation level. Food providers were listed for baseline (2020/2021) and follow-up (2023/2024).

Given that data was not normally distributed, as confirmed by Shapiro-Wilkes and Kolmogorov-Smirnov tests, non-parametric methods were used. The Wilcoxon Signed-Rank test and McNemar test was used to compare the percentages of 'red', 'amber', and 'green' menu items between the baseline and follow-up periods for ordinal and nominal data, respectively. Where Chi-square is not displayed, the exact p-value from the McNemar test was reported due to the small sample size. The Kruskal-Wallis H test was used to compare 'green', 'amber', and 'red' menu

items separately at baseline and follow-up for groups of three or more. Post-hoc pairwise comparisons or Games-Howell tests were applied to identify differences between more than two groups. For characteristics with only two groups, the Mann-Whitney U test was used. A p-value of <0.05 was considered significant, and all tests were two-tailed.

6.4. Results

6.4.1. School Demographic Characteristics

The present study included 89 primary schools, representing a 4.6% convenience sample of all NZ primary schools (n=1943), with the majority (57.3%) being contributing schools (Years 1-6) and the remaining 42.7% being full primary schools (Years 1-8; Table 6.2). Most schools were medium-sized (43.8%), followed by large schools (38.2%) and small schools (18%). Most schools (82%) were in urban areas, with 18% in rural areas. Regionally, the highest concentration of schools was in Auckland (36%), followed by Wellington (23.6%), Bay of Plenty (including Hawkes Bay) (18%), Canterbury (13.5%), Northland (6.7%), and the fewest in Otago/Southland (2.25%).

Schools in areas of high deprivation (NZDep 8–10) accounted for 12.4% of the sample, while those in medium (48.3%) and low (39.3%) deprivation areas made up the majority. Based on the EQI, most schools were classified as facing few socioeconomic barriers to education (69.7%), with 28.1% facing moderate barriers and 2.2% facing more barriers. Most schools (61.8%) were in the low deprivation decile range (8–10), compared to medium (32.6%) and high (5.6%) deprivation decile ranges.

6.4.2. Menu Composition

6.4.2.1. Nutritional Composition at Baseline and Follow-Up

Analysis of the nutritional quality of school menus over a three-year period from 2020/2021 to 2023/2024 revealed the percentage of ‘green’ menu items increased from 15.5% [7.0, 24.7] at baseline to 21.2% [8.7, 30.2] at follow-up, however no statistically significant differences were found ($Z=-1.567$, $p=0.117$) (Figure 6.2; Appendix 5: Supplementary Table 5A). ‘Amber’ menu items decreased from 44.4% [27.4, 56.9] at baseline to 33.8% [18.0, 55.4] at follow-up ($Z=-2.837$, $p=0.005$). There were no differences between the percentage of ‘red’ food items at baseline (35.4% [21.4, 47.5]) and follow-up (37.5% [25.1, 49.3]; $Z=-1.755$, $p=0.079$).

6.4.3. School Characteristics

The median percentages of ‘green’, ‘amber’, and ‘red’ food items within schools for baseline and follow-up according to characteristics such as school type, decile, school size, area, region, deprivation and EQI are presented in Figure 6.2 (Appendix 5: Supplementary Table 5B).

Table 6.2: Characteristics of New Zealand primary schools providing both baseline and follow-up school food menus.

		Primary Schools (n=89) n (%)
School type	Contributing (year 1-6)	51 (57.3)
	Full (year 1-8)	38 (42.7)
School size	Small	16 (18)
	Medium	39 (43.8)
	Large	34 (38.2)
Area	Rural	16 (18)
	Urban	73 (82)
Region [‡]	Northland	6 (6.7)
	Auckland	32 (36)
	Bay of Plenty	16 (18)
	Wellington	21 (23.6)
	South Island	14 (15.7)
Deprivation	Low deprivation (NZDep 1-3)	35 (39.3)
	Medium deprivation (NZDep 4-7)	43 (48.3)
	High deprivation (NZDep 8-10)	11 (12.4)
Equity Index [#]	Few barriers	62 (69.7)
	Moderate barriers	25 (28.1)
	More barriers	2 (2.2)
Deciles [†]	Low deprivation (deciles 8-10)	55 (61.8)
	Medium deprivation (deciles 4-7)	29 (32.6)
	High deprivation (deciles 1-3)	5 (5.6)

‡ Some regions have been combined with others due to a smaller response rate. Bay of Plenty also contains data from the Hawkes Bay, and South Island is a combination of Canterbury and Otago/Southland schools.

Equity index reported according to the Ministry of Education 'School Equity Index Bands and Groups', described according to the number of socioeconomic barriers: fewer (344-428), moderate (429-494), and more (495-569).

†The New Zealand decile school system, used from 1995 to 2022, ranked schools from 1 (high deprivation) to 10 (low deprivation) based on several socioeconomic variables, with lower decile schools receiving more funding from the Ministry of Education to address educational disparities.

6.4.3.1. School size

There were significant differences in the percentages of 'green' ($H(2)=8.713$, $p=0.013$), 'amber' ($H(2)=8.479$, $p=0.014$), and 'red' ($H(2)=12.341$, $p=0.002$) foods between small, medium, and large schools at baseline. Small schools had lower percentages of 'green' menu items (11.6%) compared to large schools (20.4%; $p=0.01$). Small schools also had a lower percentage of 'amber' foods (38.5% versus 46.8% respectively, $p=0.04$) and a higher percentage of 'red' foods 52.4% versus 28.8%, $p=0.002$) compared to medium schools.

There were differences in the percentages of 'amber' ($H(2)=9.913$, $p=0.007$) and 'red' ($H(2)=7.621$, $p=0.022$) foods between school sizes at follow-up. Small schools had a lower percentage of 'amber' food items (13.4% versus 41.2%, $p=0.005$) and a higher percentage of 'red' food items (44.4% versus 31.4%, $p=0.02$) compared to medium-sized schools.

Medium-sized schools showed a reduction in the percentage of 'amber' foods from baseline to follow-up (46.8% to 41.2%; $Z=-2.467$, $p=0.014$). Medium schools also showed a non-significant increase in 'green' foods over this time (15.5% to 20.7%; $Z=-1.949$, $p=0.051$).

6.4.3.2. Region

There were differences in the percentages of 'green' ($H(4)=13.401$, $p=0.009$), 'amber' ($H(4)=16.669$, $p=0.002$), and 'red' ($H(4)=14.791$, $p=0.005$) foods between regions at baseline. Bay of Plenty schools had a lower percentage of 'green' foods compared to Auckland schools ($p=0.022$), while Wellington schools had a larger percentage of 'amber' foods (51.0%) compared to Southland (34.3%, $p=0.044$) and Auckland (36.1%, $p=0.009$). Wellington also had a lower percentage of 'red' foods (23.5%) compared to Southland (46.6%, $p=0.013$).

There were also differences in the percentages of 'green' ($H(4)=22.712$, $p<0.001$), and 'red' ($H(4)=16.619$, $p=0.002$) foods between regions at follow-up. Bay of Plenty schools had a lower percentage of 'green' foods (7.1%) compared to both Auckland (24.4%, $p<0.001$), and Wellington (25.6%, $p<0.001$). Wellington schools had a lower percentage of 'red' foods (25.9%) compared to Auckland (46.5%, $p=0.006$), and Southland (42.9%, $p=0.026$).

Comparatively, Northland schools had a reduction in the percentage of 'amber' food items from baseline to follow-up (45.1% to 25.7%; $Z=-2.023$, $p=0.043$). Whereas Auckland schools had an increase in the percentage of 'red' food items between baseline (38.1%) and follow-up (46.5%; $Z=-2.132$, $p=0.033$).

6.4.3.3. Area

The percentage of 'amber' foods significantly decreased from baseline (45.3%) to follow-up (34.5%) for urban schools ($Z=-2.493$, $p=0.013$). There were no other significant changes for menu items across rural or urban localities from baseline to follow-up.

6.4.3.4. School Type

There was a reduction in the percentage of 'amber' foods (44.0% to 30.8%; $Z=-2.230$, $p=0.026$), and an increase in the percentage of 'red' foods (35.4% to 42.1%; $Z=-2.051$, $p=0.040$) available on school menus for contributing schools (years 1-6) from baseline to follow-up.

6.4.4. Socioeconomic Indicators

6.4.4.1. School Deciles

When comparing baseline to follow-up menus, there was a decrease in the percentage of 'amber' food items in the least deprived schools (deciles 8-10; 45.2% to 33.3%, $Z=-3.117$, $p=0.002$). There was also a significant, although modest, increase in 'red' food items between baseline (35.8%) and follow-up (39.4%; $Z=-2.417$, $p=0.016$) for the least deprived schools (deciles 8-10).

6.4.4.2. Equity Index

The percentage of 'amber' foods decreased in schools considered to have few barriers (low EQI) from baseline (45.4%) to follow-up (35.2%; $Z=-2.647$, $p=0.008$). There were no changes in the percentage of 'green' or 'red' foods from baseline to follow-up according to the EQI.

6.4.4.3. Deprivation

There were differences in the percentage of 'green' food items at follow-up based on deprivation levels ($H(2) = 6.895$, $p=0.032$). Schools found in high deprivation areas had a lower percentage of 'green' food items compared to schools in medium deprivation areas ($p=0.030$). Schools in areas of low deprivation had a reduction in the percentage of 'amber' foods between baseline and follow-up (46.2% to 30.8%; $Z=-2.555$, $p=0.011$).

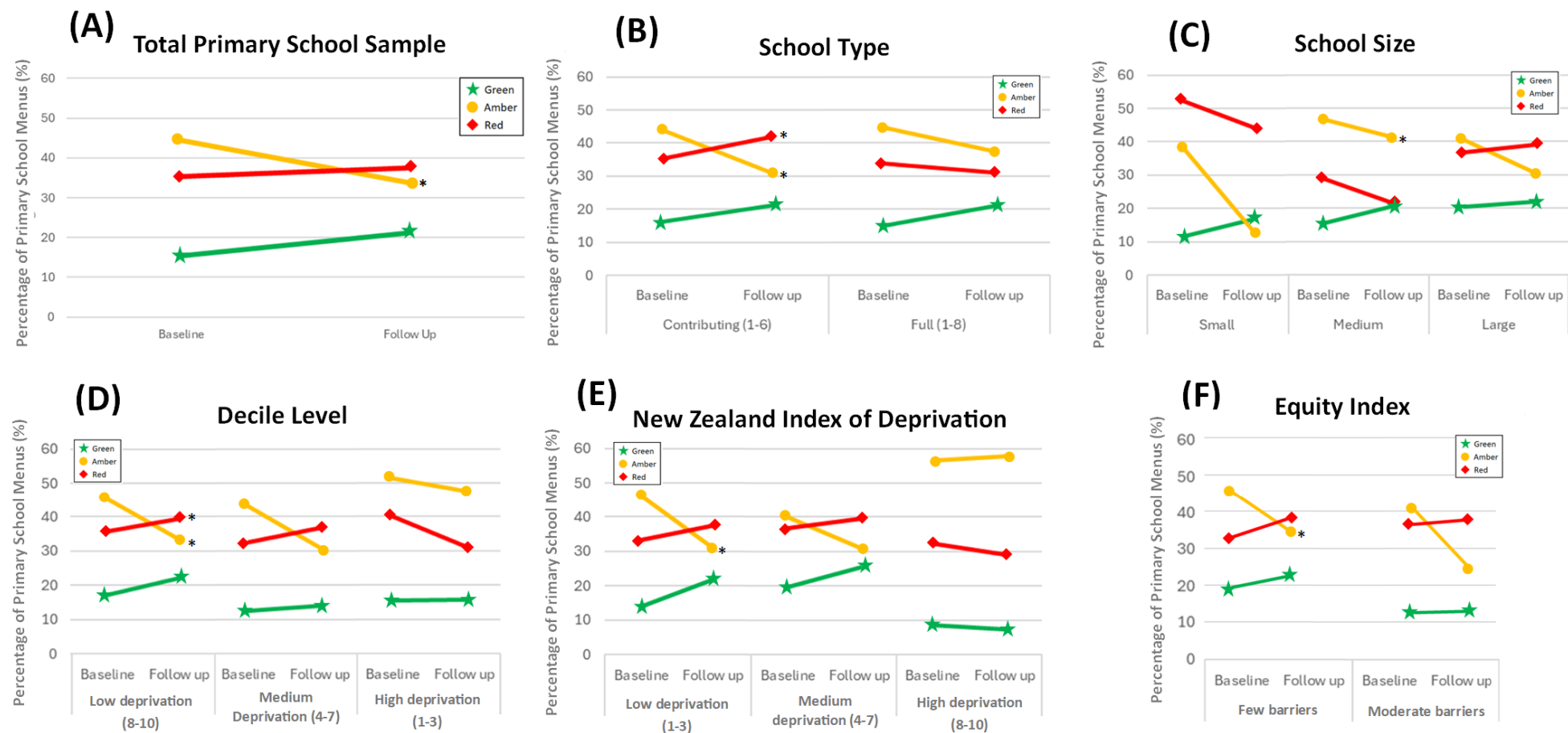


Figure 6.2: Differences in the percentage of 'green', 'amber', and 'red' foods on New Zealand primary school menus ($n=89$) based on demographic characteristics at baseline (2020/2021) and follow-up (2023/2024).

Reported as median [IQR]. Percentages of 'green', 'amber', and 'red' food items according to (A) Total primary school sample ($n=89$), (B) School Type, (C) School Size, (D) Decile Level, (E) New Zealand Deprivation Index, (F) Equity Index, (G) Area, and (H) Region. Definitions: Deciles (1-10) were ratings used by the Ministry of Education between 1995 and 2022 which ranked schools from 1 (high deprivation) to 10 (low deprivation) based on several socioeconomic variables, with lower decile schools receiving more funding. Equity Index replaced deciles in 2023 and considers a broader range of socioeconomic factors with higher scores indicating greater need for additional support and funding. Equity index is reported according the Ministry of Education 'School Equity Index Bands and Groups', described according to the number of socioeconomic barriers: fewer (344-428), moderate (429-494), and more (495-569). Schools with more barriers (EQI >495) were excluded from Figure 6.2 due to limited sample size ($n=2$). Data aggregation: Regional data were aggregated for areas with a low response rate. Bay of Plenty also contains data from the Hawkes Bay, and South Island is a combination of Canterbury and Otago/Southland schools. Percentages reported as median. *statistically significant differences ($p < 0.05$)

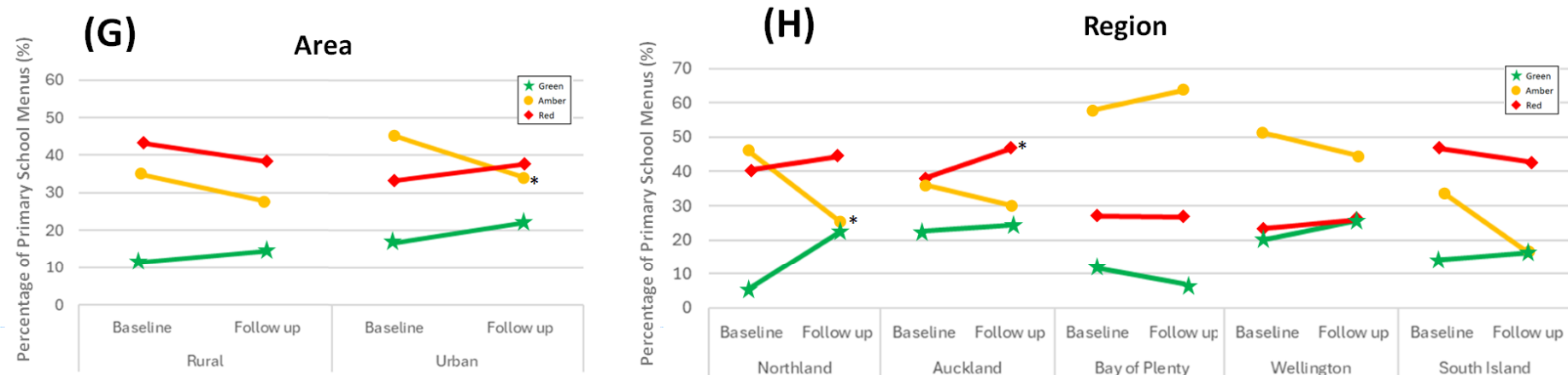


Figure 6.2 continued: Differences in the percentage of ‘green’, ‘amber’, and ‘red’ foods on New Zealand primary school menus (n=89) based on demographic characteristics at baseline (2020/2021) and follow-up (2023/2024).

Reported as median [IQR]. Percentages of ‘green’, ‘amber’, and ‘red’ food items according to (A) Total primary school sample (n=89), (B) School Type, (C) School Size, (D) Decile Level, (E) New Zealand Deprivation Index, (F) Equity Index, (G) Area, and (H) Region. Definitions: Deciles (1-10) were ratings used by the Ministry of Education between 1995 and 2022 which ranked schools from 1 (high deprivation) to 10 (low deprivation) based on several socioeconomic variables, with lower decile schools receiving more funding. Equity Index replaced deciles in 2023 and considers a broader range of socioeconomic factors with higher scores indicating greater need for additional support and funding. Equity index is reported according the Ministry of Education ‘School Equity Index Bands and Groups’, described according to the number of socioeconomic barriers: fewer (344-428), moderate (429-494), and more (495-569). Schools with more barriers (EQI >495) were excluded from Figure 6.2 due to limited sample size (n=2). Data aggregation: Regional data were aggregated for areas with a low response rate. Bay of Plenty also contains data from the Hawkes Bay, and South Island is a combination of Canterbury and Otago/Southland schools. Percentages reported as median. *statistically significant differences (p<0.05)

6.4.5. Food Items Available in School Menus

Between baseline (2020/2021) and follow-up (2023/2024) there was a shift in the presence of various menu items on school menus (Figure 6.3). Qualitative analysis revealed the presence of less healthy options decreased, with sugar-sweetened beverages reducing from 40% to 31%, ultra-processed savoury snacks (e.g., chips, crackers, instant noodles) from 42% to 33%, mixed meals with ultra-processed foods and/or deep-fried items from 49% to 45%, and baked items like sausage rolls and pies from 44% to 38%. Additionally, there was a 2% reduction in the presence of pizzas and garlic breads, and a 3% reduction in sausages and hot dogs. The presence of healthier options also decreased, with fruits and vegetables reducing from 30% to 24%, sandwiches, filled rolls, and wraps from 59% to 53%, and mixed meals without ultra-processed ingredients from 49% to 46%. There was an increase in some unhealthy food options, particularly ultra-processed sweet-food items like biscuits, chocolates, and bars which increased by 3%, and ice creams, ice blocks, and desserts which increased by 6%. There was no change in the presence of sushi and water on school menus between baseline and follow-up.

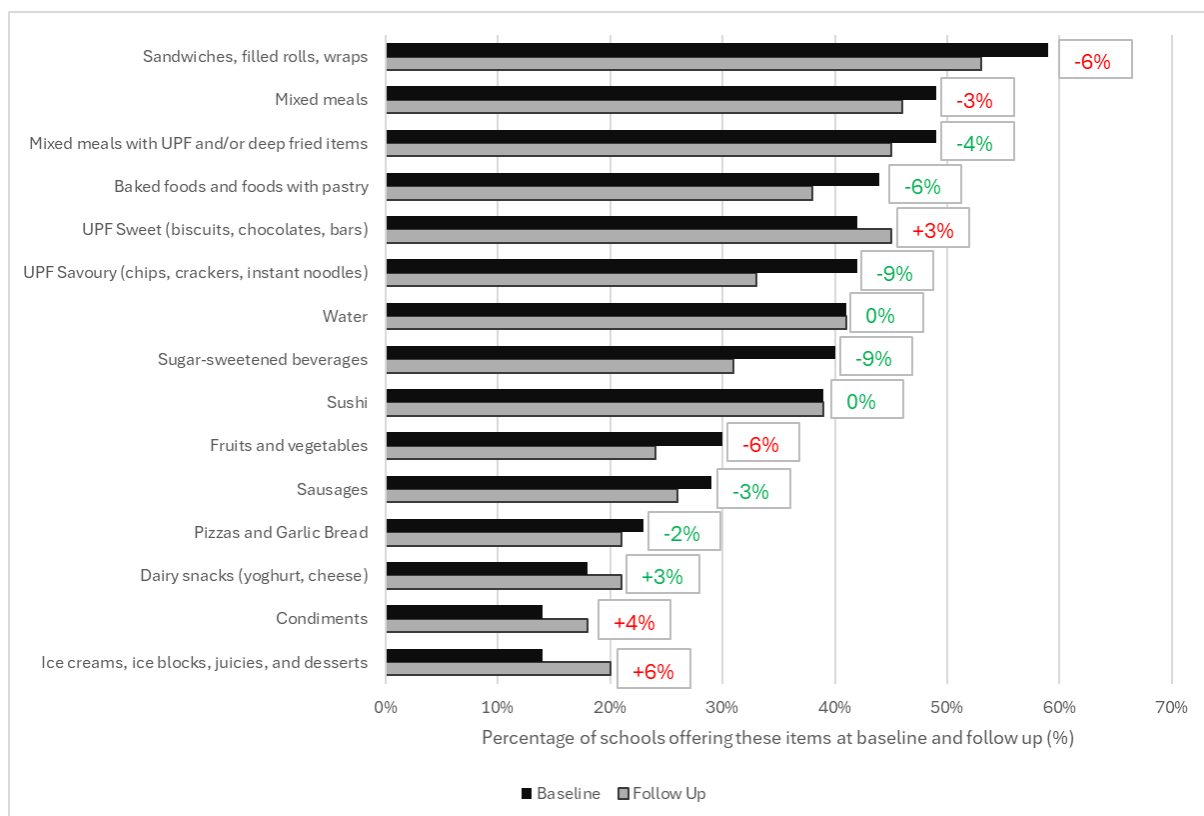


Figure 6.3: Presence of Specific Menu Items in School Menus: Baseline vs. Follow-Up.
Abbreviations: UPF, ultra processed foods.

6.4.6. Healthiness of Food Items According to School Food Providers

Between baseline and follow-up, there was a notable shift in food providers (Table 6.3). Chain providers like Subway and Pita Pit decreased significantly from 64% to 48.3% ($\chi^2=6.500$, $p=0.011$). The percentage of local providers, such as sushi outlets and bakeries, also reduced from 53.9% to 42.7%, but this change was not statistically significant ($\chi^2=2.700$, $p=0.100$). Conversely, in-house providers saw a slight increase from 16.9% to 20.2% ($p=0.607$), while school providers increased from 21.3% to 24.7% ($p=0.157$).

Table 6.3: School food providers at baseline and follow-up.

Providers	Baseline (2020/2021)	Follow-Up (2023/2024)
Chain Provider	57 (64.0%)*	43 (48.3%)*
Local Provider	48 (53.9%)	38 (42.7%)
In-House Provider	15 (16.9%)	18 (20.2%)
School Provider	19 (21.3%)	22 (24.7%)

*statistically significant ($p<0.05$)

Chain providers include Subway, Pita Pit, St Pierre Sushi, Jesters Pies, and other commercial ‘chain’ operators. Local providers include local bakeries, local sushi, local dairies, and other ‘local’ food sources. In-house providers are considered food provided by the school itself. School providers include commercial contracted food suppliers.

An analysis of the percentage of ‘green’, ‘amber’, and ‘red’ menu items offered by food providers at baseline and follow-up is illustrated in Figure 6.4. For chain providers, the percentage of ‘green’ items increased slightly from 16.7% at baseline to 18.3% at follow-up, while ‘amber’ items increased from 51.4% to 52.5%, and ‘red’ items decreased from 31.6% to 29.0%. Local providers showed a more substantial increase in ‘green’ items, from 19.2% to 28.9%, and a decrease in ‘amber’ items from 45.7% to 35.8%, with ‘red’ items remaining relatively stable (35.1% to 35.2%). In-house providers had a slight increase in ‘green’ items from 11.0% to 12.0%, a decrease in ‘amber’ items from 35.3% to 29.6%, and an increase in ‘red’ items from 53.7% to 58.5%. School providers maintained a consistent percentage of ‘green’ items (32.6%), while ‘amber’ items increased from 22.3% to 27.0%, and ‘red’ items increased from 35.0% to 40.4%. These descriptive changes are presented to illustrate patterns across provider types and do not reflect statistical significance.

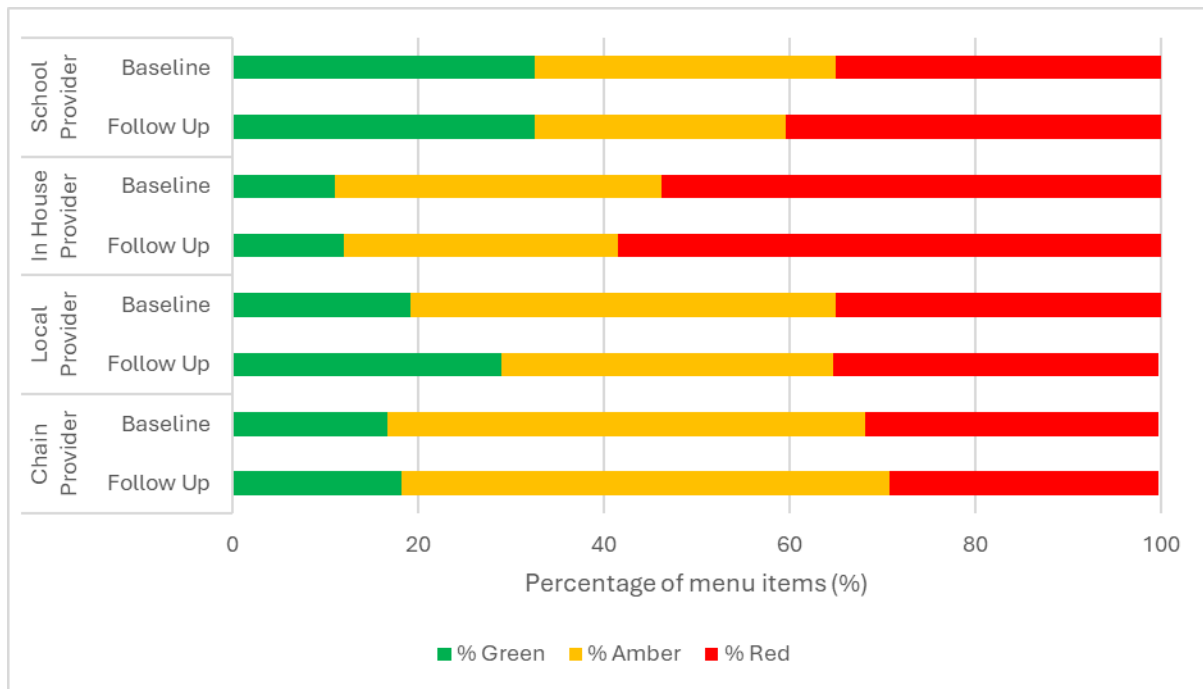


Figure 6.4: Healthiness of foods and beverages offered in schools according to school food providers.

Chain providers include Subway, Pita Pit, St Pierre Sushi, Jesters Pies, and other commercial ‘chain’ operators. Local providers include local bakeries, local sushi, local dairies, and other ‘local’ food sources. In-house providers are considered food provided by the school itself. School providers include commercial contracted food suppliers.

6.5. Discussion

A three-year follow-up evaluation of the changes in the availability of ‘green’, ‘amber’, and ‘red’ foods on school food menus between 2020/2021 and 2023/2024, following the implementation of the ‘Healthy Food and Drink Guidance for Schools’, revealed modest yet positive overall trends in school food availability. Although the slight increase in ‘green’ foods from 2020/2021 to 2023/2024 was not statistically significant (15.5% to 21.2%), the reduction in ‘amber’ foods was (44.4% to 33.8%), indicating a positive shift towards healthier options. The availability of ‘red’ foods had minimal changes (35.4% to 37.5%), and ‘green’ foods continued to make up the smallest proportion of the overall school menu suggesting further improvements are needed. A number of barriers may hinder changes to healthier foods in school canteens including reduced food sales of healthier menu items and therefore loss of school revenue (Walton et al., 2010), prevalence of unhealthy food outlets around the school competing with foods available to purchase in schools (Chote et al., 2022), and resistance from students who may prefer unhealthier food options (Chote et al., 2022; Dresler-Hawke et al., 2009; Dresler-Hawke et al., 2012).

Despite this, some unhealthy food options decreased on school menus, particularly SSBs, baked foods, and ultra-processed savoury snacks between baseline and follow-up, indicating that overall menus were moving in a positive direction. Although the last 'Children's National Nutrition Survey' was conducted in 2002, it highlighted that most NZ children brought most of their food from home (84.4%), while approximately half bought *some* of the food they consumed at school from a canteen/tuckshop (Ministry of Health, 2003b). It is important to recognise that schools play a crucial role in establishing social norms and creating food environments where healthy choices are the most accessible options (Billich et al., 2019). While many schools in NZ contract external suppliers for their school canteens/tuckshops, there was a decrease in the percentage of chain suppliers and local providers between baseline and follow-up, whereas in-house catering and larger commercial school suppliers increased. This may be attributed to the marked increase in the cost of living in NZ from 2021 (Statistics New Zealand, 2024), and schools choosing larger suppliers at a lower cost or to resource the school canteen themselves with more lower-cost unhealthy 'amber' or 'red' food options as observed in the current study.

There was a continuing trend of social inequity, with schools in more affluent areas, classified by NZDep 1-3, lower EQI scores, and decile ratings 8-10, reducing the percentage of 'amber' foods, however there were no significant changes in either a positive or negative direction for schools that faced greater socioeconomic challenges between baseline and follow-up. The percentage of 'green' foods on school menus in areas of high deprivation (NZDep 8-10) stayed consistently low between 2020/2021 (8.6%) and 2023/2024 (7.2%), with 'red' foods making up a third of all menu items (32.4% to 29%). Affordability may be a contributing factor as it has been consistently shown that unhealthy lunch items tend to be cheaper which may appeal to students and parents struggling with food insecurity (Billich et al., 2019; Carter & Swinburn, 2004; Woods et al., 2014; Wyse et al., 2017).

The findings of the present study should also be considered in the context of the global COVID-19 pandemic and the effect this had on policy implementation and school support. In March 2020, NZ went into level 4 lockdown⁴ as part of the COVID-19 nationwide response, requiring the closure of all schools (Ministry of Health, 2024b). Schools moved between online and in-person learning over the following two years depending on the alert level system in NZ. Over this time, from 2020 to 2022, the school's priority may not have been policy changes for the school canteen,

⁴ New Zealand's COVID-19 alert level system had four tiers, with Level 4 being the strictest, requiring everyone to stay at home except for essential travel, while Level 1 had no restrictions, Level 2 limited gatherings, and Level 3 allowed only purposeful travel with strict limits on gatherings.

but instead addressing food security needs, educational changes through online platforms, social needs of the school community, and student welfare (Education Review Office, 2021; Tipene-Leach & McKelvie-Sebileau, 2021). Additionally, a large proportion of the HAL nutrition promotion workforce, responsible for the implementation and facilitation of the 'Healthy Food and Drink Guidance for Schools', was redeployed to support the pandemic response which significantly impacted the workforce's ability to deliver support. The funding allocation for the HAL initiative meant that the physical activity workforce was almost five times greater than that of the nutrition workforce which has contributed to limited progress in improving school food environments. As a result, implementation of the 'Healthy Food and Drink Guidance for Schools' was inconsistent, and it is not surprising that school canteen menus have not shown widespread or sustained improvement. Greater investment in the nutrition promotion workforce is needed to support more consistent implementation and long-term improvements in school food provision.

6.5.1. Strengths and Limitations

There are several limitations that must be considered when interpreting the findings of the present study. There was a low response rate and sample attrition for the present analysis, with only 89 out of the initial 133 schools participating in the follow-up. Many low decile schools and schools in areas of high deprivation from the initial convenience sample opted in to Ka Ora Ka Ako, which was excluded from the present analysis. These factors led to a low response rate for schools facing greater socioeconomic barriers and thus may limit the generalisability of the findings. This study focussed solely on primary school canteen menus, therefore generalisability to other settings such as kura and early learning services are limited. Additionally, the data relied on school-provided menus which may have introduced self-reporting bias. The nutrition workforce for the HAL initiative encountered significant challenges during the evaluation period including health system reforms impacting national consistency, regional restructuring affecting the workforce and capacity, and the effects of the COVID-19 pandemic. Additionally, the study did not include direct measurement of the nutrition workforce's role in supporting school policy implementation due to limitations in the evaluation design and governance structures. Perspectives from key stakeholders such as principals, parents, canteen managers, and the nutrition workforce on the national guidance and its implementation in schools could provide further insights into policy uptake. The impact of COVID-19 may have also affected school operations, food availability, and policy implementation, potentially confounding the results. Despite this, the study has several strengths. The menus were coded by a registered dietitian and intercoder reliability with a secondary dietitian helped to ensure consistency in the menu

categorisation process. The menu analysis toolkit used to categorise school food items was also developed by nutrition experts enhancing the robustness of the coding.

6.6. Conclusion

Evaluation of changes in the availability of ‘green’, ‘amber’, and ‘red’ foods on primary school menus from 2020/2021 to 2023/2024 shows some positive trends, such as a reduction in ‘amber’ foods. However, the limited change in ‘red’ foods and the fact that ‘green’ foods continue to make up the smallest percentage of school menus highlights the need for further intervention. Schools play a crucial role in promoting healthy food environments, and the COVID-19 pandemic's impact on policy implementation must be considered in interpretation of these findings. National consistency in the implementation and promotion of healthy school food environments are needed, as well as monitoring and feedback to enable schools to implement healthy food and drink policies and support healthier food options in schools. Benchmarking implementation strategies that have led to greater policy uptake in the Australian context may offer valuable insights and support efforts to strengthen and mandate national guidance in NZ.

Chapter 7

Policy v. Practice: School Food Practices Do Not Reflect Healthy Food Guidance in New Zealand Primary Schools

This chapter provides a cross-sectional analysis of how school-level food policies, practices, and perceived barriers influence the healthiness of canteen menus, as assessed against the ‘Healthy Food and Drink Guidance for Schools’. It partially addresses Research Question 4: *How do school-level policies, perceived barriers, and the surrounding food environment influence the nutritional quality of foods available in New Zealand primary school canteens?* This question seeks to understand the extent to which these factors shape the availability of healthy food within NZ primary schools. This study was published in *Public Health Nutrition* (Q1, Impact Factor: 3.4, Cite Score: 6.6) in 2025. This chapter is based on work conducted and reported as of August 2025, and is presented in its original published form. Citation included below:

Pillay, D., Ali, A., & Wham, C. (2025). Policy v. practice: school food practices do not reflect healthy food guidance in New Zealand primary schools. *Public Health Nutrition*, 28(1), e184.



7.1. Abstract

Objective: To examine how school food policies and perceived barriers influence food provision in New Zealand (NZ) primary school canteens, using the ‘Healthy Food and Drink Guidance for Schools.’

Design: Cross-sectional analyses of school food menus, and school food policy and practices surveys completed by school leaders/principals.

Setting: New Zealand primary schools.

Participants: 239 primary schools completed the school food policies and practices survey, and 80 schools provided canteen menus.

Results: Most schools reported having a healthy food and drink policy in their school (76.2%) and promoted healthy eating during school hours (87.4%). Two-thirds (69.5%) identified barriers to healthy food and drink provision, most commonly the convenience of ready-made foods (39.3%), and resistance from parents (34.3%). The number of reported barriers was not a significant predictor for the presence of a school food policy (OR=1.034, $p=0.841$). School menus ($n=80$) consisted of 16.4% ‘green’ items, 34.7% ‘amber’ items, and 36.8% ‘red’ items. There was no relationship between the percentage of ‘green’, ‘amber’, and ‘red’ items and the presence of a school food policy or reported barriers. More than a third (38.9%) of menus from schools that reported they had a ‘Plain Milk and Water’ only policy still contained sugar-sweetened beverages.

Conclusions: Although most NZ primary schools had healthy food policies, this was not consistently reflected in healthy food items on canteen menus. Further research is needed to understand how systemic barriers, such as cost, convenience, and parental influence, affect policy implementation and school food provision.

7.2. Introduction

Unhealthy dietary behaviours are a contributing factor to childhood overweight and obesity, and poorer educational outcomes, health status, and mental health among children and adolescents (World Health Organisation, 2020). Dietary behaviours that develop during childhood and adolescence often continue into adulthood and may have significant impacts on the economic welfare and capacity of the healthcare system (Movassagh et al., 2017; World Health Organisation, 2013). Obesogenic food environments have been identified as a major contributor to unhealthy dietary patterns (Scaglioni et al., 2018; Swinburn et al., 1999). The school food environment has been recognised as a significant setting for influencing dietary behaviours, and

has the potential to reach the majority of children and adolescents during key periods of growth and development (Carter & Swinburn, 2004). The 'Nutrition-Friendly Schools Initiative Framework' developed by the World Health Organisation recognises that having comprehensive school nutrition policies incorporating multiple components of diet, physical activity, education, and environmental changes, can positively influence weight, diet, and health behaviours in school children (World Health Organisation, 2020).

Children attend school in New Zealand (NZ) for 6-7 hours, five days a week from the age of five years old (Ministry of Education, 2022a). Most children consume one-third of their daily food intake during school hours, and it is estimated that the average child will consume approximately 2400 lunches at school through their schooling years (Manson et al., 2022; Regan et al., 2008). The NZ school food system is complex and encompasses packed lunches, school canteens and tuckshops, commercial catering, charitable donations, and for some, the Healthy School Lunches programme (Pillay et al., 2023a). While the Healthy School Lunches programme (Ka Ora Ka Ako) in NZ was designed to provide free lunches to 25% of students most in need based on the schools' calculated equity index score (Ministry of Education, 2021), school canteens operate as facilities on site that students can purchase lunch or snacks from which also serves as source of income for the school (Ronto et al., 2020). Buying lunch from the school canteen has been associated with a higher intake of discretionary food, sugary drinks, and lower fruit and vegetable intake compared to packed lunches and food consumed at home (Chen et al., 2023; Rockell et al., 2011). The NZ government recently launched the Healthy Active Learning (HAL) initiative as part of its 'Child and Youth Well-Being Strategy' in 2020 (Sport New Zealand, 2022). In conjunction, the Ministry of Health released the voluntary 'Healthy Food and Drink Guidance for Schools' in 2020 to help schools create policies promoting healthy food and drinks within schools, replacing the 'Food and Beverage Classification System' previously used (Ministry of Health, 2020b). The guidance utilises a traffic-light system which classifies foods into 'green' (nutrient-rich), 'amber' (some nutritional value), and 'red' foods (low nutritional value, higher in saturated fat, salt, or sugar). All schools are encouraged to ensure over 75% of foods provided are in the 'green' category and that 'red' foods are not available.

Within the NZ Education (School Boards) Amendment Regulations 2022, the schools' Board of Trustees must promote healthy food and nutrition to students, and schools can develop their own policies and processes for healthy food promotion (Ministry of Education, 2022a). School food policies have the potential to have positive impacts on the availability of nutritious food and drinks within schools (Grigsby-Duffy et al., 2022; World Health Organisation, 2020). The Ministry of Health developed a 'Healthy Food and Drink Toolkit' alongside the 'Healthy Food and Drink

Guidance for Schools’ to support schools to create personalised school food policies in conjunction with students, staff, and the wider community (Ministry of Health, 2021b). School food policies provide a framework to improve the nutritional value of foods available within the school as well as promote healthy eating practices and nutrition education (Ministry of Health, 2021b). However, it has been shown that school nutrition policies in NZ are often weak and lack comprehensiveness due to the use of generalised food policy templates which lack individualisation, with poor adherence to healthy food and drink guidelines across schools (D’Souza et al., 2021; Pillay et al., 2024; Pledger et al., 2012; Vandevijvere et al., 2019). Recent cross-sectional analyses have revealed that NZ school canteens predominantly offer unhealthy food items, such as sugar-sweetened beverages (SSBs), pies and pastries, and highly processed sweet and savoury foods (D’Souza et al., 2021; Green et al., 2025; Pillay et al., 2023b). Both in NZ and internationally, multiple barriers to implementing healthy food and drink policies have been identified including lack of policy implementation support and training, resistance from the school community, and the cost and convenience of pre-packaged and convenience foods. (D’Souza et al., 2021; Ronto et al., 2020).

Few studies have explored the influence of school food policies and perceived barriers on food availability in NZ school canteens (D’Souza et al., 2021). This study aimed to assess whether the presence of school food policies and perceived barriers affect food provision within primary school canteens in NZ using the ‘Healthy Food and Drink Guidance for Schools’.

7.3. Methods

7.3.1. Healthy Active Learning

Healthy Active Learning is a joint government initiative between Sport NZ, the Ministry of Education, the Ministry of Health, and Health NZ that supports schools, kura (Māori immersion schools (Community Law, 2025)), and early learning services to improve the wellbeing of children and young people through healthy eating and drinking, and quality physical activity and curriculum delivery (Sport New Zealand, 2022).

Massey University has been contracted to evaluate the outcomes of the HAL initiative. The evaluation is a longitudinal quasi-experimental mixed methods design which began in 2020.

7.3.2. Data Collection and Participants: School Food Policies and Practices

Surveys, adapted and developed by the Massey University research team, were used to capture information about the healthy food environments in schools. ‘School Food Policy and Practices’ surveys were sent out via email to all schools between 2020-2021, and 2022-2023, in a phased

data collection period (Figure 7.1). Schools were identified via the website ‘Education Counts’ operated by the Ministry of Education (Ministry of Education, 2020a). To maximise participation across schools, email reminders were sent on four separate occasions, and responses were captured using Qualtrics software. These surveys were intended to be completed by school principals or a member of the senior management team. The surveys included whether the school had a formal, written healthy food and drink policy, policy communication and content, and school practices that promote a healthy eating environment based on the Ministry of Health guidance for schools. A total of 239 schools completed the Food Policies and Practices survey between 2020 and 2023.

Several demographic characteristics were collected to provide context for the study. School deciles, area (urban/rural), school size (number of students), and Equity Index (EQI) were obtained from the NZ Ministry of Education School Directory. Decile ratings (1-10) were previously used by the Ministry of Education between 1995 and 2022 to assess how many students lived in low socioeconomic communities. The lower the schools’ decile rating, the more funding it received from the Ministry of Education. The decile system was replaced by the EQI in 2023 due to a greater understanding of factors influencing student learning and which utilises a wider range of variables, taking into account more than just the residential neighbourhood where students reside (Ministry of Education, 2023). Both the EQI and the decile school ratings were included to allow comparison to earlier literature. The schools’ deprivation level was determined using the 2023 NZ deprivation index (NZDep). The NZDep is an area-based measure of socioeconomic deprivation in NZ based on several consensus variables where high scores correspond to higher levels of socioeconomic deprivation. Deciles were described as low deprivation (deciles 8-10), medium deprivation (deciles 4-7), and high deprivation (deciles 1-3). NZDep scores were classified as low (1-3), medium (4-6), or high (7-10). EQI was reported per the Ministry of Education socioeconomic reporting bands for 2024: low (344-428), moderate (429-493), or high (494-569) (Ministry of Education, 2025). School size was classified as small (<199), medium (200-399), or large (>400) based on the number of students.

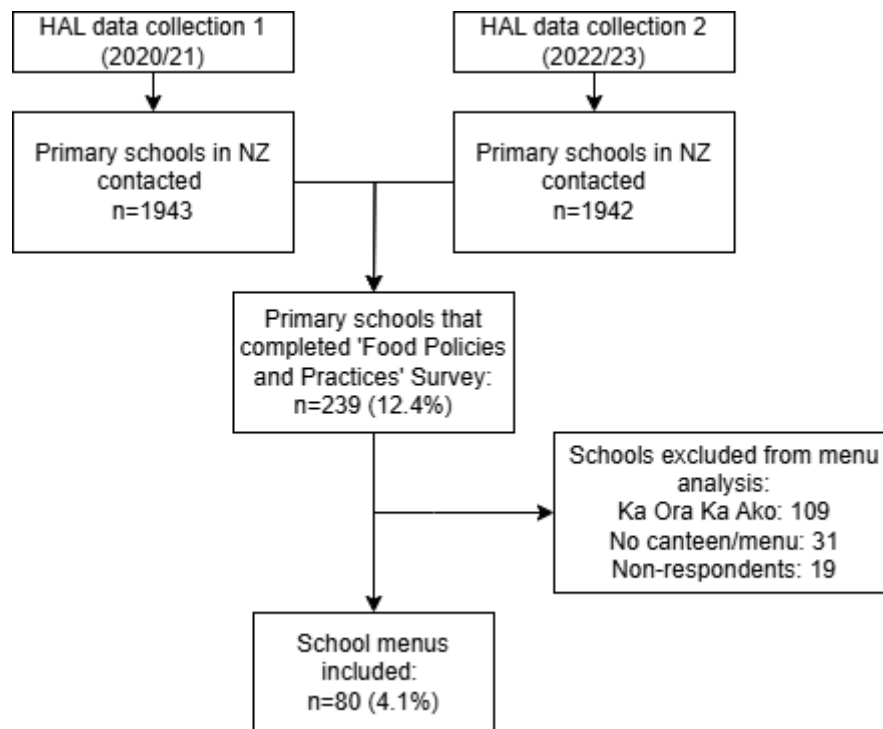


Figure 7.1: Data collection and participants completing the ‘Food Policies and Practices’ survey and providing school menus for analysis.

Percentages represent the proportion of all NZ primary schools included in this analysis.

7.3.3. Data Collection and Participants: School Menus

Schools that completed the ‘School Food Policies and Practices’ questionnaire were approached by the primary researcher between 2020 and 2023 to request a copy of their school canteen menu. Of the 239 schools that completed the ‘Food Policies and Practices’ survey, 109 schools were excluded due to their participation in Ka Ora Ka Ako (‘Healthy School Lunches’ programme by the Ministry of Education) which likely altered their food provision systems beyond the school’s control. There were a further 31 schools excluded who had no canteen or food menu, and 19 schools that did not respond to the request for their menu. Overall, a total of 80 schools provided menus included in the present menu analysis (Figure 7.1).

7.3.4. Menu analysis

A team of four researchers (three nutritionists and one dietitian) developed a quick menu audit tool in 2021, termed the ‘Menu Analysis Toolkit’ to assess all menus collected in the HAL evaluation. Details of the toolkit, including development and categorisation of food items, have been reported previously (Pillay et al., 2023b). In summary, the toolkit offers a detailed breakdown of commonly packaged foods and meals/main menu items available to purchase in schools, categorised according to a traffic-light system based on the Ministry of Health ‘Healthy

Food and Drink Guidance for Schools'. The traffic-light system classifies school menu items as 'green' (nutrient-rich), 'amber' (some nutritional value), and 'red' (low nutritional value, higher in saturated fat, salt, or sugar). A registered dietitian completed the school menu analysis using the 'Menu Analysis Toolkit', with 10% of the menus assessed by a second dietitian to ensure consistency in food classification.

7.3.5. Statistical Analysis

Descriptive analyses were conducted for demographic variables, healthy food and drink policies in schools, and school practices that promote a healthy eating environment. Chi-square tests of independence were used to examine the relationship between school characteristics (type, region, decile, equity index, deprivation, school size, and area) and the presence of a food and drink policy, as well as the relationship between water and milk only policies and the presence of SSBs. Normality was tested using the Kolmogorov-Smirnov and Shapiro-Wilk tests, which indicated that the data for the percentage of 'green', 'amber', and 'red' foods were not normally distributed. Consequently, the Mann-Whitney U test was used to determine differences in the percentage of food items ('green', 'amber', and 'red') between schools with food policies and those reporting barriers. A binary logistic regression model was used to investigate whether the number of reported barriers predicted the presence of a food policy. All tests were two-tailed and a p-value <0.05 was considered significant.

7.4. Results

A total of 239 schools were included for analyses. Schools were evenly split between contributing (49%) and full primary (51%), with most located in the Upper North Island (33.1%) and urban areas (67.8%; Appendix 6: Supplementary Table 6A). Most schools stated that they had a healthy food and drink policy in their school (76.2%), while 5.4% of schools reported that they did not have a food policy but would like to have one (Table 7.1). Sixty-four schools provided details on their school food policy, of which 53 reported their policy was on the website 'SchoolDocs' (SchoolDocs, 2025). 'Plain milk and water only' was stipulated by 52.7% of schools, while 28.9% did not make the distinction. Schools stated that the policy was likely to be utilised by the Board of Trustees (55.2%), followed by whānau (family; 49%), with food providers and canteen providers less likely to use it (22.6% and 5%, respectively). Healthy food and drink policies were mainly communicated via the school newsletter (68.2%) and at staff meetings (53.6%). Most were able to source the new Ministry of Health 'Healthy Food and Drink Guidance for Schools' from either the Ministry of Health (30.5%) or Ministry of Education (35.6%) website, but 16.3% of schools were not aware of the new guidance (Table 7.1).

Table 7.1: Healthy Food and Drink Policies in Schools.

		Total sample (n=239) n (%)
Presence of a healthy food and drink policy	Yes	182 (76.2)
	No but would like to	13 (5.4)
	No	30 (12.6)
Policy stipulates water and plain milk only	Yes	126 (52.7)
	No	69 (28.9)
Who is likely to utilise the policy*	Board of trustees	132 (55.2)
	Whānau (family)	117 (49.0)
	Students	104 (43.5)
	PTA	62 (25.9)
	Food providers	54 (22.6)
	Canteen providers	12 (5.0)
How is the policy communicated*	School newsletter	163 (68.2)
	Staff meetings	128 (53.6)
	School website	108 (45.2)
	Student assemblies	96 (40.2)
	Email to staff, students and others	61 (25.5)
	Information seminars/workshops	12 (5.0)
Awareness of 'Healthy Food and Drink Guidance for Schools'	Sourced from MoE website	85 (35.6)
	Sources from MoH website	73 (30.5)
	Not aware of guidelines	39 (16.3)

Abbreviations: MoH, Ministry of Health; MoE, Ministry of Education; PTA, Parent-Teacher Association.

*multichoice answers.

Some schools did not provide answers to certain questions.

Most (87.4%) schools promoted healthy eating during school hours (Table 7.2). Fundraising support was reported by 15.1% of schools using products from food and beverage companies such as Cadbury/Whitakers chocolate, Bakers Delights, Cookie Time cookies, pie providers, and Pita Pit. More than half of schools (59%) agreed or strongly agreed that their school had sufficient water fountains, while 22.2% of schools either disagreed or strongly disagreed with this statement. External charitable support for food provision was reportedly received by 60.3% of schools, with Kickstart Breakfast (44.8%) and KidsCan (34.7%) the most common initiatives.

Table 7.2: Health Promoting School Practices.

		Total sample (n=239) n (%)
Promotion of healthy eating during school hours	Yes	209 (87.4)
	No	3 (1.3)
Fundraising support by food and beverage companies†	Yes	36 (15.1)
	No	177 (74.1)
Sufficient water fountains in the school	Agree / strongly agree	141 (59)
	Disagree / strongly disagree	53 (22.2)
	Neither agree / disagree	27 (11.3)
Participation in an external programme	Yes	144 (60.3)
	No	76 (31.8)
External programmes*	Kickstart Breakfast	107 (44.8)
	KidsCan	83 (34.7)
	Fonterra Milk in Schools	80 (33.5)
	Free School Lunches (Ka Ora Ka	71 (29.7)
	Fruit in Schools	69 (28.9)
	Community Breakfast Club	23 (9.6)
	Eat My Lunch	11 (4.6)

*multichoice answers.

† examples of fundraising support by food and beverage companies included Cadbury/Whitakers chocolate, Bakers Delights, Cookie Time cookies, Pita Pit, pie providers (Oxford/Fairlie/Naked Baker). Some schools did not provide answers to all questions.

There were no significant differences between school characteristics (deciles, equity index, deprivation, size, area, type, and region) and the presence of a healthy food and drink policy ($p>0.05$; Appendix 6: Supplementary Table 6A). Two-thirds (69.5%) of schools reported a barrier to healthy food and drink provision, the most common being the convenience of ready-made food and drinks (39.3%), followed by resistance from parents (34.3%; Figure 7.2). Approximately 21.8% of schools reported no barriers to healthy food and drink provision. The number of reported barriers was not a significant predictor of the presence of a school food policy (OR-1.034, $p=0.841$).

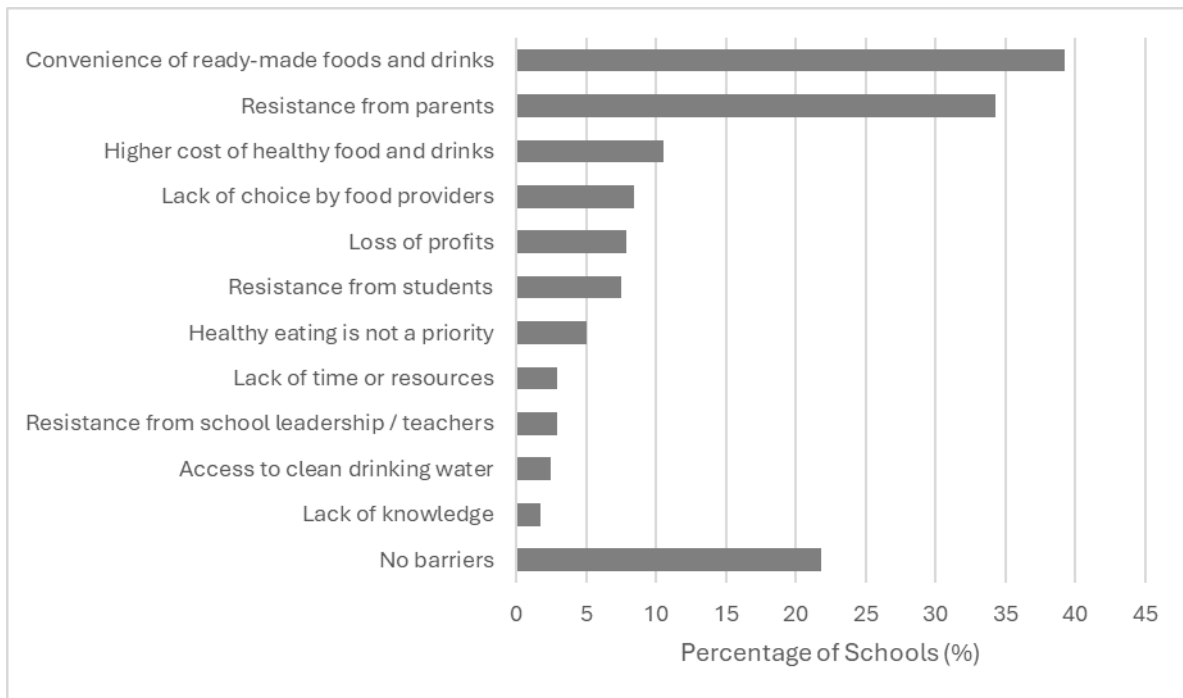


Figure 7.2: Barriers to healthy food and drink provision in schools.

Multiple response answers. A total of 166 schools reported at least one barrier.

7.4.1. Menu Analysis

A total of 80 schools provided their food menus for analyses. The overall composition of these school menus comprised of a median 16.4% of 'green' items, 34.7% 'amber' items, and 36.8% 'red' items (Figure 7.3A; Supplementary Table 6B). There were no significant differences in the percentages of 'green' ($U=466$, $p=0.858$), 'amber' ($U=446.5$, $p=0.668$), and 'red' ($U=439.5$, $p=0.605$) food items between schools that had a healthy food and drink policy and those that did not (Figure 7.3B).

'Green' food items were lower in schools that reported barriers (9.7%) compared to schools that did not (25%), however this did not reach statistical significance likely due to the small sample size and variation in within the groups ($U=428.5$, $p=0.457$). There were no differences in 'amber' ($U=459.5$, $p=0.741$), and 'red' ($U=480.5$, $p=0.958$) foods between schools that reported barriers and those that reported no barriers to implementing a healthy food and drink policy (Figure 7.3C).

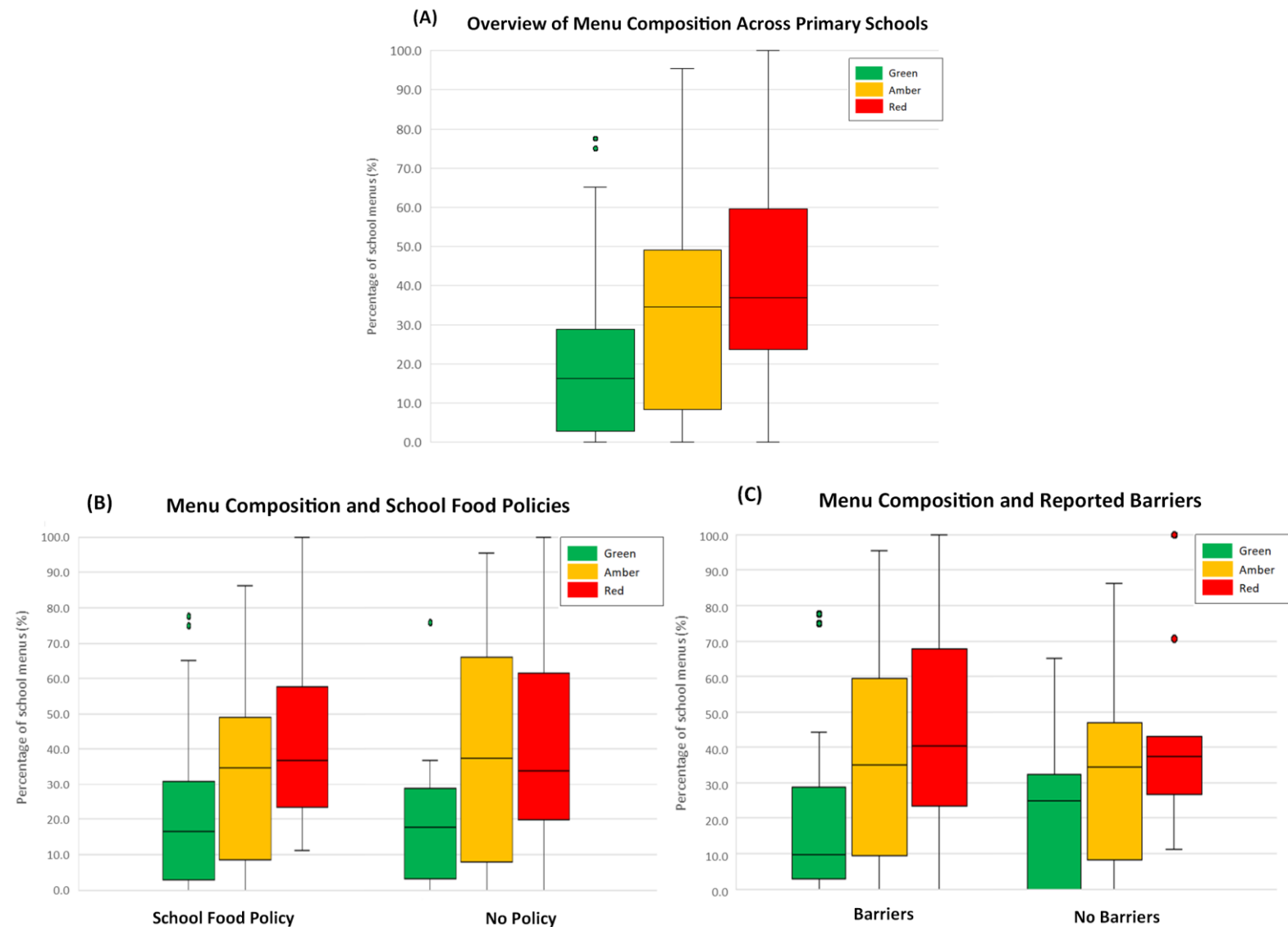


Figure 7.3: Healthiness of school food menus based on the presence of a Healthy Food and Drink Policy or perceived barriers

Values reported as median [25th, 75th percentile]. Percentages of ‘green’, ‘amber’, and ‘red’ food items according to (A) total menu sample, n=80 schools, (B) presence of a school food policy, and (C) reported barriers to healthy food and drink provision. The ‘No Policy’ category includes those who would like to have a food policy but currently do not. A total of 51/80 schools listed at least one barrier to providing healthy food and drinks in schools and are represented in the ‘Barrier’ category.

Almost half of schools (42.5%) had sugar-sweetened or ‘red’ classified beverages, per the ‘Healthy Food and Drink Guidance for Schools’, available on their school food menus. The majority of sugar-sweetened or ‘red’ classified beverages available on school menus were juice/flavoured water (30%), followed by flavoured milk (16.3%) and other beverages including popsicles, frozen milk desserts, smoothies/blended fruit drinks (17.5%). Exclusive water and plain milk were present in 52.5% of school food menus. There was no association between having a ‘Plain Milk and Water’ only policy and the presence or absence of sugar-sweetened or ‘red’ classified beverages ($\chi^2(1)=0.820$, $p=0.365$). More than a third (38.9%) of menus from schools that stated they had a ‘Plain Milk and Water’ only policy still contained sugar-sweetened or ‘red’ classified beverages (Figure 7.4).

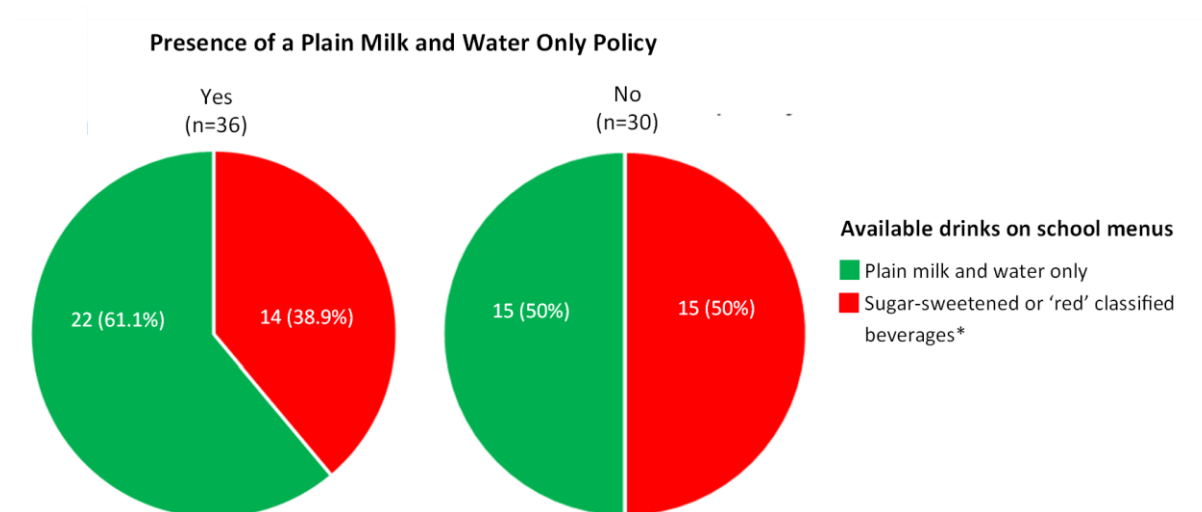


Figure 7.4: ‘Plain Milk and Water Only’ policies and the availability of sugar-sweetened or ‘red’ classified beverages on school menus

*‘Red’ classification as per the Ministry of Health ‘Healthy Food and Drink Guidance for Schools’ in New Zealand which includes sugar-sweetened beverages, smoothies, milk-based drinks with added sugar, fruit/vegetable juices (including those with no added sugar), energy drinks and sports drinks, and flavoured water.

7.5. Discussion

This study highlights the persistent challenges in improving the nutritional quality of food menus in NZ primary school canteens. While most schools reported having a healthy food and drink policy (76.2%) and many promoted healthy eating (87.4%), this was not reflected in the food offered on school menus. Most school food menus were made up of unhealthy ‘red’ foods (36.8%), followed by ‘amber’ foods (34.7%), with healthy ‘green’ foods making up the smallest proportion (16.4%). The lack of association between reported barriers and school food policies on food provision suggest that broader systemic factors such as school resources, government

support, and prioritisation by schools may influence food provision more than just policy existence. Implementing healthy food policies is often low on the list of school priorities when it comes to available resources and time, educational priorities, and socioeconomic barriers (Ronto et al., 2020; Tipene-Leach & McKelvie-Sebileau, 2021). It has been reported that negative attitudes of school staff, limited sense of responsibility for students dietary choices, and disagreement among staff members is a hindrance towards healthy food and drink policies (Ronto et al., 2020). However, adequate funding, effective policy communication and management, and positive attitudes have been reported as facilitators of policy implementation (Ronto et al., 2020).

Alongside the 'Healthy Food and Drink Guidance for Schools', many schools used a generic template from the website 'SchoolDocs' for their food and nutrition policies. While these templates have previously been shown to offer good comprehensiveness, their limited strength from using suggestive instead of prescriptive language, may reduce their overall effectiveness (Chote et al., 2022; D'Souza et al., 2021). This is highlighted by the 38.9% of schools who stated having a 'plain milk and water only' policy yet still offered sugar-sweetened or 'red' classified beverages on the school menu. School food policies need to be tailored to the specific needs of each school, as individualised approaches are a crucial factor in shaping the school food environment and ensuring meaningful impact (Chote et al., 2022). Additionally, the voluntary nature of the 'Healthy Food and Drink Guidance for Schools' means that without proactive direction from staff or parents, food environments are often deprioritised and fail to adequately support students in making healthy dietary choices (Coady et al., 2025). There has been variable uptake of similar government school guidelines across several Australian territories with few schools eliminating 'red'/'banned' food items from school canteens despite guidelines being mandated (Clinton-McHarg et al., 2018; Haynes et al., 2020; Hill et al., 2023; Reilly et al., 2021). However, Western Australian schools have shown greater compliance, with 89% of schools meeting the nutritional criteria (>60% 'green' items, <40% 'amber' items') (Myers et al., 2019). This is likely due to the presence of clear and quantifiable targets, as well as the requirement for school principals to assess and report on the healthiness of their school canteen each year, highlighting that enforcement is critical for policy adoption and implementation (Myers et al., 2019; Nathan et al., 2016; Pillay et al., 2024).

Multi-component interventions which integrate leadership support and engagement, staff training, tools and resources, and monitoring and feedback has been shown to improve the implementation of healthy food and drink policies within schools (Nathan et al., 2016; Pillay et al., 2024; Reilly et al., 2018; Wolfenden et al., 2017). While the 'Healthy Food and Drink Guidance

for Schools' remains voluntary, schools will need support to implement and prioritise healthy food and drink policies. The Theoretical Domains Framework (TDF), comprising of 14 domains, offers a valuable lens for understanding the behavioural factors that influence policy implementation and adherence (Cane et al., 2012). In Canada, the TDF was used to systematically examine barriers and facilitators affecting teachers' implementation of the mandated Daily Physical Activity policy, with environmental context and resources, beliefs about consequences, social influences, knowledge, and intentions emerging as key domains to inform targeted interventions and policy refinement (Weatherson et al., 2017). Similarly, in Australia, the TDF was used to assess perceived barriers and enablers to dietary guideline implementation among early childhood education centre cooks, revealing that social/professional role and identity, beliefs about consequences, and skills were influential domains, with the skills domain significantly associated with greater menu compliance (Grady et al., 2018). These findings highlight the value of theory-informed approaches in identifying implementation challenges and informing the design of more effective, context-specific interventions (Cane et al., 2012).

Consistent with previous findings, the most common barriers to healthy food and drink provision were the convenience of ready-made foods (39.3%) and resistance from parents (34.3%). Low cost and convenience of ready-made foods are often cited as a barrier to healthy food provision (Coady et al., 2025; D'Souza et al., 2021; Ronto et al., 2020), however a recent analysis of Australian lunchboxes, comparable to the NZ setting and economy, highlighted that lunchboxes made up of only healthy food items cost AUD\$1.53 less than lunchboxes made up of >50% unhealthy foods on average (Manson et al., 2024). Similarly, a randomised controlled trial of the implementation of a healthy canteen policy in Australia highlighted that there were no adverse financial effects of a healthier menu on canteen revenue (Wolfenden et al., 2017). Further research is needed to evaluate the financial implications of providing healthier food and drink options within the NZ school canteen setting. Interestingly, school principals and leaders reported that food and canteen providers were the least likely to utilise a healthy food and drink policy which may reflect limited opportunities for providers to contribute to policy decisions. Addressing barriers like cost and convenience through subsidies or partnerships with healthier food suppliers may help overcome some challenges. Increasing the prices of unhealthy food items to subsidise the cost of healthy foods could help balance the higher costs of healthier options while also discouraging student purchases of less nutritious choices (Chote et al., 2022). However, further investigation is warranted to assess potential unintended consequences such as increased purchasing of unhealthy foods from external food retailers around schools.

As shown in the last children's nutrition survey in NZ (2002), more than half of children bought some of the food consumed at school from the school canteen, however the majority (84.4%) brought most of their food from home (Ministry of Health, 2003b). There has been limited data reported on the usage of school canteens in NZ in the last twenty years (Ministry of Health, 2003b; Utter et al., 2007). However, more recent data from Australia reflects a similar trend, with 84% of surveyed parents (n=359) indicating that their children brought packed lunches to school every day (Nanayakkara et al., 2024). Further studies are needed to investigate the extent to which students use school canteens and how this has changed over time in NZ. Schools' perceptions of parental support for food policies may be influenced by implicit biases based on school lunch boxes (McKelvie-Sebileau et al., 2023; Nanayakkara et al., 2024) potentially leading to misunderstandings about parental priorities. Recent cross-sectional quantitative and qualitative studies in Australia investigating parent perspectives on school food provision found that healthy and balanced meals were the most important factor for parents with regards to school food provision (Aydin et al., 2023; Manson et al., 2025). It is widely recognised that parents and students should be consulted in the development of school food policies and programmes (Ministry of Health, 2021b; NZ Children's Commissioner, 2013; Pillay et al., 2023a), however, parents and students in NZ have reported a lack of communication from schools with regards to changes to the food system and food policies (McKelvie-Sebileau et al., 2023). Students benefit from lunch systems that involve them in menu planning and support autonomy, while parents emphasise the importance of non-stigmatising approaches to food that promote positive relationships with eating (Manson et al., 2025; McKelvie-Sebileau et al., 2023). Engaging students and parents in the restructuring of school canteens to align with school food policies may help address schools' concerns while ensuring that parental priorities as key stakeholders are acknowledged and integrated (Manson et al., 2025; McKelvie-Sebileau et al., 2023).

7.5.1. Strengths and Limitations

This study represents the first analysis of the impact of school food policies and reported barriers on primary school canteen menus in NZ, using the 'Healthy Food and Drink Guidance for Schools'. This study utilised a canteen menu audit tool, with menu coding completed by the primary researcher and dietitian, with reliability testing conducted by a second dietitian familiar with the dataset and menu analysis toolkit, ensuring consistency and accuracy in classification. Additionally, the study utilises a well-established traffic-light categorisation system to assess the nutritional value of foods, similar to Australia. This enhances comparability across Australia and NZ, which have similar school food provision models, allowing for broader insights into school food environments.

There are several limitations that must be considered when interpreting the results of the present study. Data collection for school menus took place in 2023/24, whereas school food policies and practices questionnaires were collected in 2020/21 and others in 2022/23 as part of the structure of the HAL evaluation. This difference in timing means that any changes in school policies or priorities over the years may not have been fully captured. Additionally, the comprehensiveness of food policies was not assessed, limiting the ability to examine how detailed policies influence school menus. Although 239 schools completed the food policies and practices survey, the menu analyses included only 80 schools, which may not provide a fully representative view of school food environments. Future studies with a larger sample of school food menus may better highlight barriers and enablers to healthy food provision. Both the surveys and menus relied on self-reported data, introducing the possibility of bias and incomplete responses based on who was responsible for completing the survey. Social desirability bias may have influenced responses, leading some schools to overstate their adherence to healthy food guidelines and practices.

7.6. Conclusions

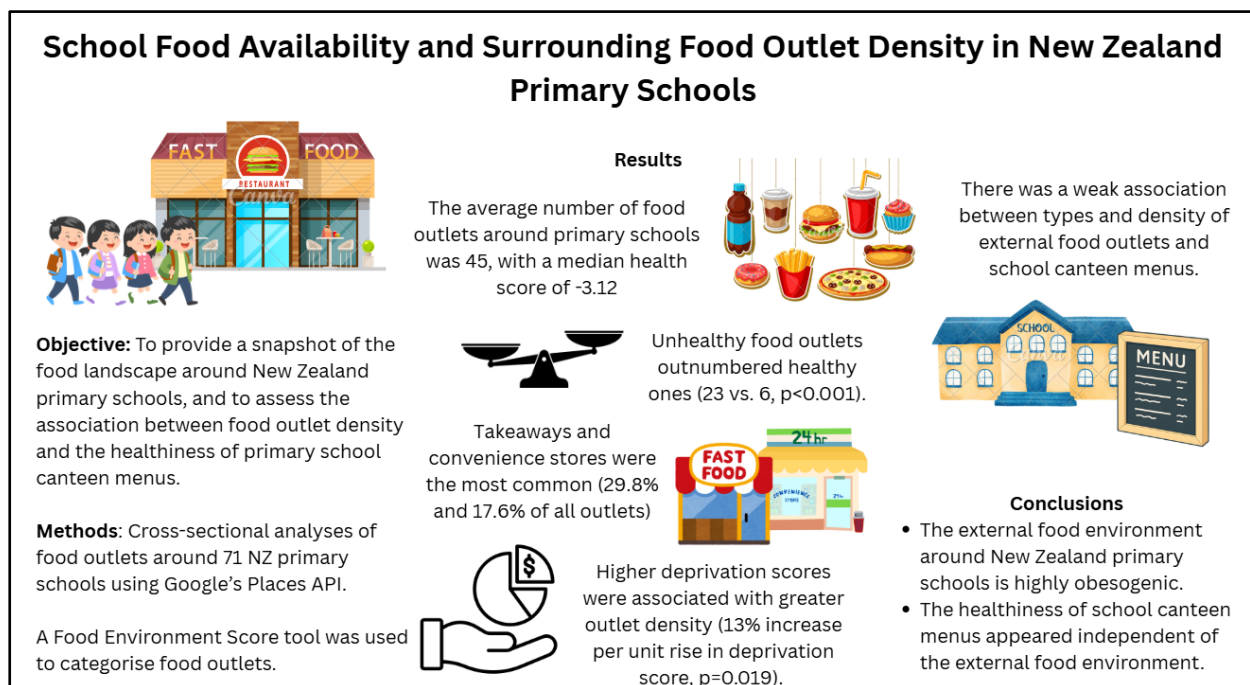
This study highlights the challenges in implementing and maintaining healthy food and drink policies in NZ primary schools. While most schools report having healthy food and drink policies, inconsistencies in school practices and the prioritisation of food environments mean that these policies are not effectively reflected on school canteen menus. Standardised policy templates, while useful, lack the strength needed for meaningful implementation. The dominance of 'red' food items on menus suggests that systemic barriers, including cost and convenience, parental support, and stakeholder engagement, may play a more significant role in food provision than policy existence alone. Implementing multicomponent interventions which include monitoring and feedback measures may help to ensure compliance with healthy food policies, particularly while the 'Healthy Food and Drink Guidance for Schools' remains voluntary.

Chapter 8

School Food Availability and Surrounding Food Outlet Density in New Zealand Primary Schools

This chapter examines the broader food environment surrounding New Zealand primary schools through a cross-sectional analysis of the density and types of nearby food outlets. Together with Chapter 7, it addresses Research Question 4: *How do school-level policies, perceived barriers, and the surrounding food environment influence the nutritional quality of foods available in New Zealand primary school canteens?* This chapter explores how the external foodscape may shape the availability of healthy food options within schools.

This chapter is based on work conducted and reported as of April 2026. This study was submitted to *Public Health Nutrition* (Q1, Impact Factor: 3.4, Cite Score: 6.6) and is currently under review.



8.1. Abstract

Objective: To provide a snapshot of the food landscape around New Zealand (NZ) primary schools, and to examine the association between food outlet density and the healthiness of primary school canteen menus.

Design: Cross-sectional analyses of external food outlets around schools, and school canteen menus.

Setting: New Zealand primary schools.

Participants: 71 primary schools provided their school canteen menu, and all external food outlets within 1.6-km of these schools were mapped using Google's Places API.

Results: The average number of food outlets around primary schools was 45, with a median health score of -3.12 (indicating a higher proportion of unhealthy outlets). Unhealthy food outlets outnumbered healthy ones (23 vs. 6, $p < 0.001$), with takeaways and convenience stores most prevalent (29.8% and 17.6%, respectively). 83% of schools had at least one takeaway outlet within 1.6-km. Higher deprivation scores were associated with greater outlet density with a 13% increase per unit rise in deprivation score ($p = 0.019$). School canteen menus comprised 19.7% healthy 'green', 35.1% occasional 'amber', and 35.5% unhealthy 'red' food items. There was a weak negative association between types and density of external food outlets and school canteen menus.

Conclusions: The food environment around NZ primary schools is highly obesogenic, with greater exposure to unhealthy outlets observed in more deprived areas, reinforcing the need for zoning regulations to promote health equity. The healthiness of school canteen menus showed little associated with the external food environment. Despite widespread exposure to nearby takeaway outlets, schools demonstrated variable adherence to national nutrition guidance. Strengthening implementation support for schools may be more impactful than regulating the surrounding foodscape alone.

8.2. Introduction

A third of New Zealand (NZ) children aged 2-14 years have been overweight or obese over the last decade (Ministry of Health, 2024a). Obesity is a complex public health issue that requires broad and overarching population-based solutions (Brug et al., 2008; Swinburn et al., 1999). The food environment, defined as the collective physical, economic, policy, and sociocultural surrounds, plays a crucial role in the development of children's dietary behaviours, and has implications in

the prevention of childhood obesity, impacting health and wellbeing later in life (Osei-Assibey et al., 2012; Pillay et al., 2023a; Vandevijvere et al., 2019). Obesogenic food environments have been defined as ‘the sum of influences that the surroundings, opportunities, or conditions of life have on promoting obesity in individuals and populations’ (Swinburn et al., 1999). While food environments play a key role in shaping health behaviours, improving these behaviours at a population level also requires individuals to have the motivation and capability to act healthily, supported by social and physical environments that provide opportunities for healthy choices (Brug et al., 2008).

In an environment that offers easy opportunities for healthy behaviours, an individual may need less motivation and fewer skills to be able to make healthful choices (Brug et al., 2008). The school food environment is an opportune setting to shape the dietary behaviours of children, given that children spend the majority of their weekday waking hours in a school setting (Ministry of Education, 2000). International systematic reviews and meta-analyses have highlighted that interventions aimed at improving the school food environment have shown benefits in increasing healthful behaviours of children including increased fruit and vegetable consumption, as well as having beneficial effects on BMI and metabolic health (Micha et al., 2018; Pineda et al., 2021). However, in NZ, there is little monitoring of school food environments and a lack of strong government policy, with the responsibility on the schools’ board of trustees to promote healthy food and drinks within schools (Chote et al., 2022; Ministry of Education, 2024). While school food and nutrition policies may be comprehensive, they lack strength due to the heavy reliance on generic standardised food policy templates (Chote et al., 2022; Swinburn et al., 2014). The NZ school food environment is suboptimal in its current state, with many school canteens dominated by unhealthy foods and sugar-sweetened beverages (D’Souza et al., 2021; Green et al., 2025; Pillay et al., 2023b). It has been shown that canteen/tuckshop use is associated with a greater consumption of high fat and high sugar foods. In particular, a NZ study highlighted that children who bought most of their food from the school canteen were more likely to drink soft drinks, and consume pastries, and highly processed sweet snacks more often than those who did not use the canteen (Utter et al., 2007).

The potential influence of the external food environment on children’s diets is complex and likely mediated by home, community, and school settings (Walton et al., 2009). While the majority of health promotion efforts are spent on improving the internal school food environment (Health New Zealand, 2025; Pineda et al., 2021; Sport New Zealand, 2022), it has been reported both nationally and internationally that implementing healthy food and drink policies within schools to improve the healthiness of the foods available in school canteens are often hindered by the

perceived impact of the proximity and density of unhealthy food outlets around schools (Chote et al., 2022; Ronto et al., 2020). The potential association between surrounding food outlets and school food availability may operate indirectly, through competitive and economic pressures on school food provision. In an international systematic review (n=28) examining barriers and enablers to implementing healthy food and drink policies in schools, seven identified geographical proximity of external food retailers selling discretionary foods as a major barrier, affecting policy implementation and the profits of food providers within schools (Ronto et al., 2020).

Evidence from NZ suggests that retail food environments are unevenly distributed, with schools in socioeconomically deprived areas more likely to be closer to fast-food/takeaway outlets (Pearce et al., 2007). Similarly, these areas are more likely to have higher numbers of convenience stores and alcohol outlets compared to more affluent areas (Pearce et al., 2008). A study in NZ (n=1102) investigating the preferences of children highlighted that primary-school aged children reported enjoyment when going to shops to consume unhealthy food and drink, and were less likely to make healthy choices when unsupervised (Egli et al., 2020). Similar results were seen in a wearable camera study in NZ (n=37) which highlighted that all food and drink purchased by children aged 11-14 years were considered noncore/unhealthy (McKerchar et al., 2020). Children are particularly vulnerable to food marketing and advertising, and it has been shown that children's exposure to unhealthy food and drink marketing, often found in abundance around schools (Brien et al., 2023; Frost et al., 2026; Huang et al., 2020; Sneyd et al., 2023), correlates with dietary preference and consumption (Frost et al., 2025). Greater distances from food shops have also been shown to be significantly associated with lower fast-food consumption in NZ children under the age of 14 years (n=4175) (Jenkin et al., 2015). There are few zoning laws and policies in NZ that place limits on the density or placement of food outlets selling unhealthy foods, and this has remained relatively unchanged over the last decade (Mackay et al., 2023; Swinburn et al., 2014). Instead, district councils establish permitted activities within zones, including commercial operations such as restaurants and takeaways, but do not regulate the number or location of food outlets. While councils have public health responsibilities, no council has yet adopted specific zoning rules to limit fast food density near schools despite advocacy and public health efforts (Swinburn et al., 2014).

Only a handful of studies have investigated the density and type of food outlets surrounding NZ schools, with all data collected before 2015 (Clark et al., 2014; Day & Pearce, 2011; Day et al., 2015; Maher et al., 2005; Vandevijvere et al., 2016; Walton et al., 2009). Only two studies have assessed food outlets in NZ on a national scale (Pearce et al., 2007; Vandevijvere et al., 2016). In

a temporal analysis of food outlets in NZ, it was observed that over a 40-year period, despite a decrease in the median number of food outlets within 800 metres of primary schools (from nine in 1966 to six in 2006), there was an overall increase in the number of fast-food outlets from one to four (Day et al., 2015). Similarly, a recent analysis of food outlets around schools in Wagga Wagga and Blacktown, Australia, found that the number of outlets increased by 76% between 2007 to 2023, likely due to increased demand and population growth (Tse et al., 2025). With a 14% increase in the NZ population over the last decade (Statistics New Zealand, 2025), the food environment is likely to have shifted significantly to accommodate population growth, urban density, and demand for convenience foods.

The present study aims to provide an up-to-date snapshot of the current food landscape around NZ primary schools, and to examine the association between food outlet density around schools and the healthiness of NZ primary school canteen menus.

8.3. Methods

8.3.1. Healthy Active Learning

Healthy Active Learning (HAL) is a joint government initiative between Sport NZ, the Ministry of Education, the Ministry of Health, and Health NZ that supports schools, kura (Māori immersion schools) and early learning services to improve the wellbeing of children and young people through healthy eating and drinking, and quality physical activity and curriculum delivery (Sport New Zealand, 2022).

Massey University has been contracted to evaluate the outcomes of the HAL initiative, including the healthiness of the food environment surrounding primary schools. The evaluation is a longitudinal quasi-experimental mixed methods design which began in 2020.

8.3.2. Study Design and Methods

The present study is a cross-sectional analysis of food outlets surrounding a convenience sample of primary schools across NZ (n=71) assessed as part of the HAL evaluation. Food outlet data was collected in April 2024 using an automated data collection endpoint known as Google's Places API.

8.3.3. School Selection

Surveys, adapted and developed by the Massey University research team, were used to capture information about the healthy food environments in schools. 'School Food Policy and Practices' surveys were distributed to all schools via email between 2020-2023, with responses collected

using Qualtrics software. Contact details for schools were obtained via the website 'Education Counts' (Ministry of Education, 2020a). These surveys were intended for school principals or members of the senior management team to complete. The surveys included whether the school had a formal written healthy food and drink policy, how it was communicated, and the school's practices in promoting a healthy food environment. A total of 239 schools completed the Food Policies and Practices survey between 2020 and 2023.

Schools that completed the 'School Food Policies and Practices' questionnaire were contacted by the primary researcher in October 2023 to request a copy of their school canteen menu. Of the 239 schools that completed the survey, 109 schools were excluded due to their involvement in Ka Ora Ka Ako (the Ministry of Education's 'Healthy School Lunches' programme) which likely influenced their food provision systems beyond the school's control. An additional 31 schools were excluded because they did not have a canteen or food menu, while 19 schools did not respond to the request for their menu. A total of 80 schools provided school food menus.

8.3.4. School Characteristics

Demographic characteristics of the participating schools were collected. The school deciles, geographic area, and size were sourced from the NZ Ministry of Education's 'School Directory' and the Equity Index (EQI) was obtained from the Ministry's 'School EQI Numbers 2023–2024' document. The NZ decile school system, used from 1995 to 2022, ranked schools from 1 (most deprived) to 10 (least deprived) based on several socioeconomic variables, with lower decile schools receiving more funding from the Ministry of Education. In 2023, the decile system was replaced by the EQI, which considers a broader range of socioeconomic factors with higher scores indicating greater need for additional support and funding. For comparative purposes both measures were included. Deciles were described as low deprivation (deciles 8-10), medium deprivation (deciles 4-7), and high deprivation (deciles 1-3). The 2023 NZ Deprivation Index (NZDep), an area-based measure of socioeconomic deprivation, was used to determine schools' deprivation levels. NZDep scores were classified as low deprivation (NZDep 1-3), medium deprivation (NZDep 4-6), or high deprivation (NZDep 7-10). The EQI was categorised using the Ministry of Education 'School Equity Index Bands and Groups' for 2024, which reflect socioeconomic barriers to education: fewer barriers (344-428), moderate barriers (429-494), and more barriers (>495) (Ministry of Education, 2025). School size was included as a contextual characteristic reflecting surrounding population density and commercial activity, and was classified as small (≤ 199), medium (200-399), or large (≥ 400) based on student numbers.

8.3.5. Outlet Density Mapping

Although several walking distances have been reported in previous literature, the present study characterised a walkable distance as a 1.6-km catchment area around a school, considering the broad age range of students in the present sample (years 1 to 8 corresponding to ages 5 to 13 years old) (Chillón et al., 2015). Google's Places API, a programmatic interface to Google's database, was used to retrieve data for all registered food outlets within a 1.6-km radius of each primary school which provided school canteen menus for analysis (n=80). Seventeen string-terms were used to find food outlets around schools after multiple iterations of parameter refinement based on categories developed as part of 'Food Environment Score' tool for Australian food environments (Moayyed et al., 2017; Needham et al., 2020), and Google Business categories.

The string terms used were "Alcohol", "Bakery", "Bar", "Butcher", "Café", "Convenience", "Deli", "Food", "Fruit", "Gas", "Grocery", "Poultry", "Restaurant", "Seafood", "Supermarket", "Takeaway", and "Vegetable". The data was collected from Google's Places API in compliance with their terms of use. To determine the spatial relationship between schools and food outlets, geographic distances were calculated using the Geopy library, which utilises the Haversine formula to compute great-circle distances between two sets of latitude and longitude coordinates. Outlets with invalid or missing coordinates were excluded from this analysis to avoid introducing errors in distance calculations.

8.3.6. Mapping and Visualisation

A map of the study area was generated using the Folium library, a Python tool that allows interactive maps to be created and visualised in a web browser (Figure 8.1). The map utilised a grayscale base map to emphasise the markers for the outlets and schools. The RegularPolygonMarker function in Folium was used to represent outlets with different shapes, based on their health category: 'green' outlets were marked with triangles, 'amber' outlets with squares, and red outlets with circles. School locations were marked with black square markers. While analyses were conducted based on outlet density within a 1.6-km radius, both a 1.6-km and 800m buffers are shown for illustrative purposes.

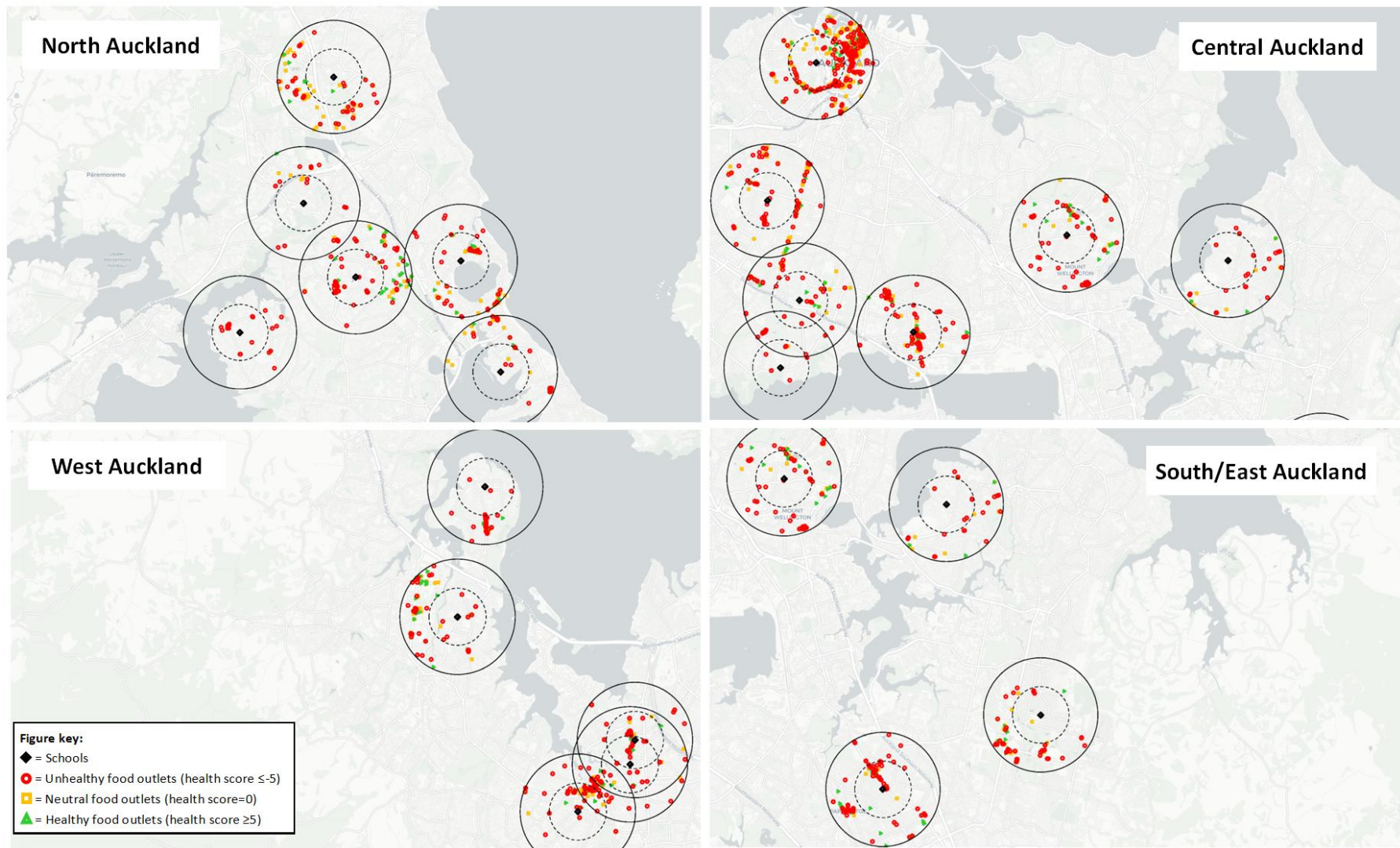


Figure 8.1: Visualisation of food outlet density around schools in Auckland, New Zealand ($n=20$).

Visualisation created using Folium Library from data collected through Google's Places API. Two circumferences are displayed: Solid line, 1.6 km; dotted line, 800 m from school. Key: Red circles indicate unhealthy food outlets (health score ≤ -5), yellow squares indicate neutral food outlets (health score = 0), and 'green' triangles indicate healthy food outlets (health score ≥ 5). Black diamonds indicate schools. All markers are not able to be seen on this figure due to marker overlap. Full visualisation available as a supplementary file on request.

8.3.7. Outlet Categorisation

Of the 80 schools, nine did not have any food outlets within the specified radius, therefore 71 primary schools across NZ were used to collect data from Google's Places API. A total of 6,684 outlets were found through the API. Several types of outlets were removed manually from the initial dataset which were not applicable to the present analysis including online retailers with a registered business address, petrol stations without a general store retailer, catering companies that did not sell food on premise, farming and pet supplies, agriculture supplies, garden centres, and community venues/social clubs. After exclusion, a total of 6,336 food outlets remained. After mapping and visualisation, it was discovered that Google's Places API also included 'relevant' food outlets outside the specified 1.6-km search area and these were removed leaving a total of 4,176 food outlets for inclusion in the present analysis.

Food outlets were individually and manually categorised according to a 'Food Environment Score' tool (Moayyed et al., 2017; Needham et al., 2020), which was further refined for use in a NZ setting to include liquor/vape shops and include references to NZ colloquial terms for outlets such as a 'dairy' which would be considered a 'general/convenience store' (Table 8.1). Health scores ranging from -10 to 10 were used to quantitatively assess the healthiness of food outlets with negative numbers corresponding to unhealthy food outlets, and positive numbers indicating healthy food outlets. A health score of 0 was considered neutral and may contain both healthy and unhealthy food options. Investigation using Google images, business webpages, Facebook, and other social media were used to categorise ambiguous food outlets such as cafés or restaurants which may also have offered takeaways. Where food outlets were too ambiguous to distinguish, researcher discretion was used. To improve the reliability of the categorisation, 10% of the dataset was independently reviewed by a second and third researcher. An agreement rate above 85% was considered reliable (Cheung & Tai, 2023), and the researchers reached 92% agreement.

Table 8.1: Food outlet categories and corresponding health scores*.

Food outlet type	Description	Health Score
Takeaway - franchise store	E.g. McDonalds, KFC, Subway; mainly engaged in the preparation and sale of meals (excludes donuts, drinks, ice-cream etc.) or snacks that are ready for immediate consumption; table service not provided; meal can be eaten on site, taken away or delivered; the food shop is a franchise/chain store with food being sold in specialised packaging.	-10
Liquor / vapes	Mainly engaged in the sale of liquor/alcohol/vapes	-10
Dessert shops / Specialty food store - extra foods	Mainly engaged in the sale of foods such as ice-creams, donuts, waffles, cakes etc. than can be defined under extra food.	-8
Takeaway - local independent	E.g. kebab, fish & chips, burger, chicken shops, local pizza, mainly engaged in the preparation and sale of meals/snacks that are ready for immediate consumption; table service not provided; meals can be eaten on site; taken away or delivered; shop is not a franchise.	-8
General store	Mainly engaged in the sale of a limited line of groceries generally includes milk, bread and canned and packaged foods. Includes superettes/dairies/petrol stations. Can be classified as a convenience store as well.	-5
Pub/bar	e.g. pub within a bowling park, pub inside a private gambling club; food primarily engaged in selling alcoholic beverages where consumers can order and consume the alcoholic drinks in premises; can also be part of park or private club.	-5
Restaurant/café - franchise	E.g. franchise restaurants and cafes; mainly engaged in the preparation and sale of meals/snacks for consumption on the premises; table service provided; may sell alcohol with food; may provide takeaway services.	0
Restaurant/café - Local independent	e.g. restaurant in a golf club, culture-based restaurant/café which is not a take-away such as Mexican, Thai, Chinese etc.; mainly engaged in the preparation and sale of meals/snacks for consumption on the premises; table service provided; may also sell alcohol with food, may provide takeaway services.	0
Delicatessen	Mainly engaged in the sale of specialty packaged or fresh products such as cured meats and sausage, pickled vegetables, dips, bread and olives; may also provide dine in meals.	0
Bakery	Mainly oriented towards bread, biscuits, pastries or other flour products with or without packaging.	0

Major supermarket	Mainly engaged in the sale of groceries (fresh foods, canned and packaged foods, dry goods) of non-specialised (conventional) food lines. May contain a butcher or baker. Usually have 5 or more checkouts and a floor area over 1000 square meters. I.e. Woolworths, Pak'n'Save, New World	5
Minor supermarket	Mainly engaged in the sale of groceries (fresh foods, canned and packaged food, dry goods) of non-specialised (conventional) food lines. Usually have 4 or fewer checkouts and a floor area under 1000 square meters. E.g. Independent grocer or supermarket.	5
Specialty food stores - core foods	Mainly engaged in the sale of a limited line of specialised food such as a particular gourmet food that can be defined under core food.	5
Sandwich shop	Mainly engaged in the preparation of filled bread products like sandwiches or rolls.	5
Salad/sushi bar	Mainly engaged in the preparation of salads (Pita Pit) and sushi.	5
Fish shop	Mainly engaged in the sale of fresh seafood; including wholesale stores with direct to public sales and takeaway stores also providing a range of fresh seafood.	9
Poultry shop	Mainly engaged in the sale of fresh poultry; including wholesale stores and with direct to public sales.	9
Butchery	Mainly engaged in the sale of fresh meat; including wholesale stores with direct to public sales.	9
Fruiterer & greengrocer	Mainly engaged in the sale of fresh fruit and vegetables; including wholesale stores with direct to public sales	10

*Adapted for the NZ context from the established 'Food Environment Score' tool developed for use in an Australian retail environment (Moayyed et al., 2017; Needham et al., 2020).

8.3.8. School Canteen Menu Analysis

In 2021 a team of three nutritionists and one dietitian created a quick-audit tool for assessing school canteen menus, called the 'Menu Analysis Toolkit', for use in the HAL evaluation. The development and categorisation process for this toolkit has been previously documented (Pillay et al., 2023b). The menu analysis toolkit provides a comprehensive breakdown of commonly available packaged foods and main menu items available to purchase in schools, categorised using the traffic-light system from the Ministry of Health's 'Healthy Food and Drink Guidance for Schools' (Ministry of Health, 2020b). The traffic-light system has three categories, 'green' (nutrient-dense), 'amber' (moderate nutritional value), or 'red' (higher in saturated fat, salt, or

sugar, with lower overall nutritional value). A registered dietitian completed the school menu analysis using the 'Menu Analysis Toolkit', with 10% of the menus assessed by a second dietitian to ensure consistency in food classification.

8.3.9. Statistical Analysis

Statistical analyses were performed using IBM SPSS statistics package version 27 (SPSS Inc.) Descriptive analyses were conducted for demographic variables, total number of food outlets, health score, and the number of healthy and unhealthy food outlets around schools. Normality was tested using the Kolmogorov-Smirnov and Shapiro-Wilk tests, which indicated that the data for the number of food outlets around schools and health scores were not normally distributed. Consequently, Mann-Whitney U and Kruskal Wallis tests were used to determine differences in the number of total food outlets, health score, healthy food outlets, and unhealthy food outlets according to demographic variable categories. Wilcoxin-Signed Rank test was used to determine differences between the number of healthy and unhealthy food outlets across the total sample, and according to demographic variables.

Generalised Linear Models (GLMs) were used to assess the relationship between food outlet density and the composition of school canteen menus. Separate models were run for total, healthy, and unhealthy food outlets as predictors, with the percentage of 'green', 'amber', and 'red' food items on school canteen menus as dependent variables. Given the continuous nature of the data, a gamma distribution with an identity link function was applied. Model fit was assessed using likelihood ratio chi-square tests. A negative binomial GLM with a log link function was used to assess the relationship between demographic variables and the total, healthy, and unhealthy food outlet density around schools. All tests were two-tailed, with statistical significance indicated by $p < 0.05$.

8.4. Results

8.4.1. Food outlets around schools

All food outlets were assessed around 71 primary schools in NZ (Table 8.2). The median number of food outlets around schools was 45.0, with a health score of -3.12. There were more unhealthy food outlets around primary schools compared to healthy food outlets (23.0 vs. 6.0, respectively; $z = -7.152$, $p < 0.001$). The median percentage of different food outlets around NZ primary schools are represented in Figure 8.2. Takeaways made up the largest percentage (29.8%) of food outlets surrounding primary schools, followed by general/convenience stores (17.6%), and restaurants (15.6%). Healthful outlets made up a smaller percentage of total food outlets with major and

minor supermarkets making up 2.2% and 4.0%, respectively, and salad, sushi and sandwich bars making up 2.7% of all outlets. Pubs/bars represented 6.8% of outlets around schools, while liquor and vapes stores made up 0.3%.

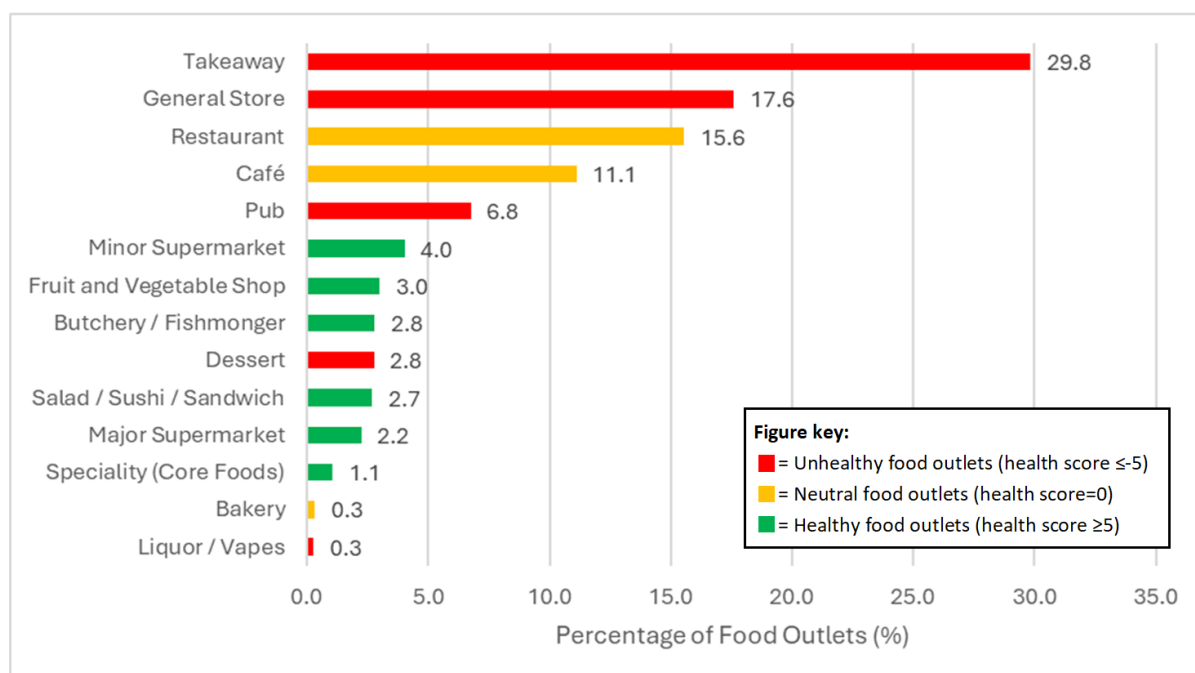


Figure 8.2: The percentage of food outlets around a sample of New Zealand primary schools ($n=71$).

Most schools had a general store within a 1.6-km radius (91.5%), followed closely by takeaway outlets (83.1%), restaurants (80.3%), and cafés (78.9%) (Figure 8.3). Almost two-thirds of schools had a pub/bar within the walking catchment area (64.8%). More than half of schools had a supermarket, major (63.4%) or minor (60.6%), within walking distance. Healthier options such as fruit and vegetable shops (56.3%), sushi/salad bars (56.3%), and butcheries (59.2%) were common but less prevalent in comparison. Liquor/vape stores were the least common, found near only 12.7% of schools.

8.4.2. Demographics

A total of 71 schools were included in the present study, with 60.6% classified as contributing schools (Years 1–6) and 39.4% as full primary schools (Years 1–8; Table 8.2). Schools were distributed across five regions: Upper North Island (29.6%), Central North Island (11.3%), Lower North Island (18.3%), Upper South Island (23.9%), and Lower South Island (16.9%). Based on decile classification, 9.9% of schools were in the high deprivation category (deciles 1–3), 35.2% in medium (deciles 4–7), and 54.9% in the low deprivation category (deciles 8–10). EQI scores showed 52.1% of schools in the 'fewer barriers' category, 46.5% with 'moderate barriers', and 1.4%

with ‘more barriers’. Deprivation levels were evenly spread based on the NZDep classification with 31% of schools in low deprivation areas, 35.2% in medium, and 33.8% in high deprivation areas. School size varied, with 29.6% classified as small, 38% medium, and 32.4% large. Most schools (74.6%) were in urban areas, while 25.4% were in rural locations.

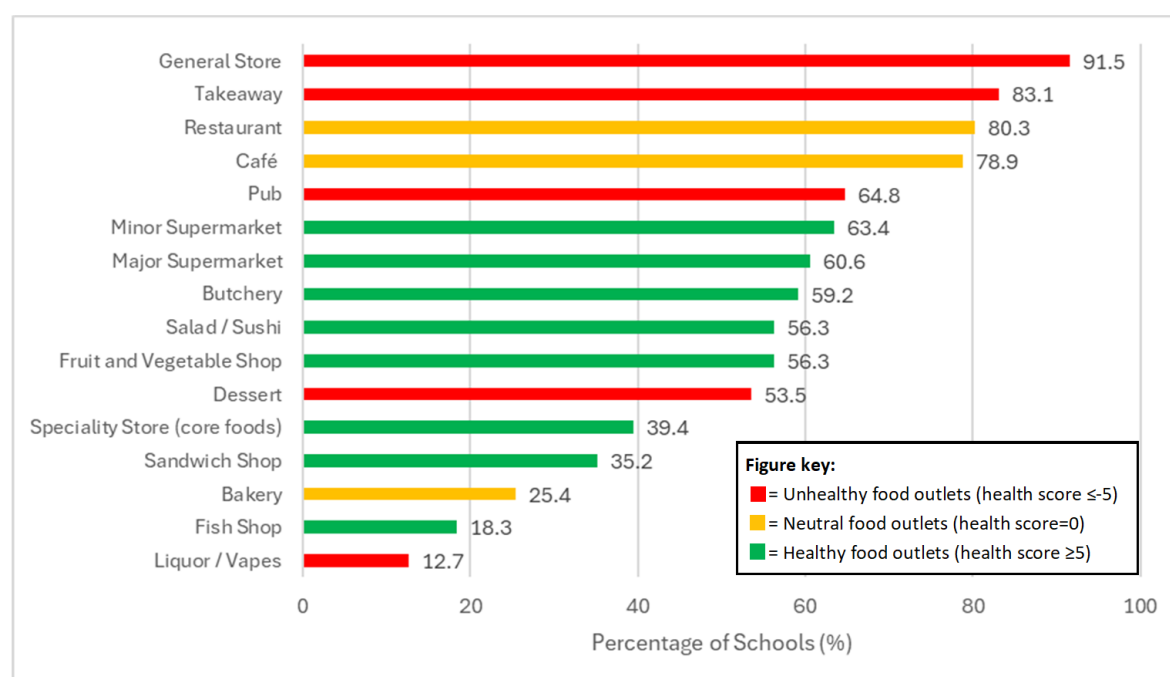


Figure 8.3: Percentage of schools with nearby food outlets by type (1.6 km radius).

8.4.2.1. Total number of food outlets according to demographic variables

There were no significant differences in the number of food outlets across school deciles ($H(2)=2.468$, $p=0.291$), urban and rural schools ($U=534$, $Z=0.754$, $p=0.451$), or contributing and full primary schools ($U=533$, $Z=-0.806$, $p=0.420$). However, schools with a low EQI score (fewer barriers) had more food outlets than those in the medium EQI (moderate barriers) category (52 vs. 20; $H(2)=10.405$, $p=0.006$; $p=0.008$). NZDep score was associated with food outlet density ($H(2)=12.966$, $p=0.002$), with high deprivation areas having more outlets than medium (92 vs. 27; $p=0.004$) and low deprivation areas (27; $p=0.007$). Food outlet numbers also varied by school size ($H(2)=12.475$, $p=0.002$), with small schools having fewer outlets than medium (6 vs. 51; $p=0.021$) and large schools (56; $p=0.002$). Significant regional differences were observed ($H(4)=26.530$, $p<0.001$), with fewer outlets near schools in the central North Island (34; $p=0.006$), upper South Island (23; $p=0.001$), and lower South Island (4.5; $p<0.001$) compared to the upper North Island (105 outlets). Across all demographic categories, there were more unhealthy food outlets compared to healthy food outlets ($p<0.05$).

Higher NZDep scores were significantly associated with food outlet numbers ($\chi^2(1)=168.874$, $p<0.001$; $B=0.123$, $SE=0.052$, $p=0.019$), with a 13% increase per unit rise in deprivation score. Region was also associated with outlet density, with schools in the upper North Island ($\chi^2(1)=232.404$, $p<0.001$; $B=1.152$, $SE=0.468$, $p=0.006$) and lower North Island ($\chi^2(1)=168.874$, $p<0.001$; $B=0.948$, $SE=0.503$, $p=0.006$) having significantly more outlets. Other demographic variables, including school type, area, size, decile, and equity index, were not significantly associated with outlet density.

8.4.2.2. Health score of food outlets according to demographic variables

Median health scores of food outlets around primary schools ranged from -3.83 to -2.50 across demographic variables. There were no differences in the food outlet health score based on deprivation ($H(2)=2.170$, $p=0.338$), equity index ($H(2)=2.329$, $p=0.312$), or deciles ($H(2)=0.686$, $p=0.710$). Similarly, health scores did not vary by school size ($H(2)=1.321$, $p=0.517$), region ($H(4)=8.055$, $p=0.090$), school type ($U=557.5$, $z=-0.524$, $p=0.601$), or area ($U=532$, $z=0.727$, $p=0.467$).

8.4.2.3. Healthy food outlets according to demographic variables

The number of healthy food outlets varied by NZDep score ($H(2)=13.015$, $p=0.001$), with more outlets near schools in high deprivation areas compared to medium (13.5 vs. 3; $p=0.010$) and low deprivation areas (13.5 vs. 4; $p=0.003$). Schools with a low EQI score (fewer barriers) also had more healthy food outlets than those with a medium EQI score (9 vs. 3; $H(2)=11.438$, $p=0.003$), while decile rating showed no differences ($H(2)=2.438$, $p=0.296$).

Significant regional differences were observed ($H(4)=25.950$, $p<0.001$), with schools in the upper North Island having a greater proportion of healthy food outlets compared to the central North Island (18 vs. 5; $p=0.038$), upper South Island (4; $p=0.001$), and lower South Island (1; $p<0.001$). School size was also associated with healthy food outlet numbers ($H(2)=14.478$, $p<0.001$), with small schools having fewer outlets than medium (1 vs. 8; $p=0.037$) and large schools (1 vs. 9; $p=0.001$).

Higher NZDep scores were significantly associated with the number of healthy food outlets ($\chi^2(1)=6.562$, $p=0.010$; $B=0.147$, $SE=0.057$, $p=0.010$), corresponding to a 15.9% increase in healthy food outlets per unit rise in deprivation score. Region was also significantly associated with healthy food outlet density, with schools in the upper North Island ($\chi^2(1)=4.410$, $p=0.036$; $B=1.066$, $SE=0.508$, $p=0.036$) and lower North Island ($\chi^2(1)=4.399$, $p=0.036$; $B=1.124$, $SE=0.536$, $p=0.036$) having more options. Other variables, including area, school type, equity index, and decile, were not significantly associated with healthy food outlet density.

Table 8.2: Distribution and healthiness of food outlets around New Zealand primary schools (n=71) according to demographic variables.

		Total sample n (%)	Number of food outlets [†]	Health score of food outlets [†]	Number of healthy food outlets [‡]	Number of unhealthy food outlets [‡]	Healthy vs unhealthy [‡] p-value
All schools		71 (100)	45.0 [12.5, 95.0]	-3.12 [-3.87, -2.37]	6.0 [2.0, 15.5]	23.0 [6.5, 47.5]	<0.001
Type	Contributing (1-6)	43 (60.6)	46.0 [12.5, 100.0]	-3.09 [-3.77, -2.43]	7.0 [2.0, 16.0]	26.0 [7.0, 51.0]	<0.001
	Full primary (1-8)	28 (39.4)	33.0 [15.0, 64.5]	-3.35 [-3.99, -2.14]	4.5 [2.0, 11.5]	21.0 [6.5, 40.5]	<0.001
Region [§]	Upper North Island	21 (29.6)	105.0 [56.0, 133.0]*	-3.10 [-3.83, -2.47]	18.0 [10.0, 22.0]*	51.0 [31.0, 71.0]*	<0.001
	Central North Island	8 (11.3)	34.0 [9.0, 52.0]*	-3.83 [-4.74, -2.57]	5.0 [1.5, 6.5]*	18.0 [7.5, 32.0]*	0.012
	Lower North Island	13 (18.3)	46.0 [25.0, 90.0]	-3.47 [-3.95, -3.18]	8.0 [2.0, 14.0]	28.0 [16.0, 46.0]	0.002
	Upper South Island	17 (23.9)	23.0 [9.0, 48.0]*	-2.50 [-3.13, -1.97]	4.0 [1.0, 8.0]*	12.0 [5.0, 32.0]*	<0.001
	Lower South Island	12 (16.9)	4.5 [3.0, 17.0]*	-2.51 [-4.17, -0.19]	1.0 [0.0, 3.5]*	3.0 [1.5, 8.5]*	0.007
Decile [¶]	Low deprivation (8-10)	39 (54.9)	36.0 [12.0, 80.5]	-3.10 [3.89, -1.93]	6.0 [1.5, 13.5]	18.0 [6.5, 41.0]	<0.001
	Medium deprivation (4-7)	25 (35.2)	48.0 [10.0, 108.0]	-3.25 [-3.81, -2.47]	5.0 [3.0, 16.0]	23.0 [5.0, 51.0]	<0.001
	High deprivation (1-3)	7 (9.9)	73.0 [55.0, 104.5]	-3.12 [-3.72, -2.59]	12.0 [8.50, 20.0]	48.0 [31.0, 53.0]	0.018
Equity Index	Fewer barriers	37 (52.1)	52.0 [34.0, 104.0]*	-3.18 [-3.82, -2.57]	9.0 [5.0, 16.0]*	31.0 [19.0, 54.0]*	<0.001
	Moderate barriers	33 (46.5)	20.0 [3.0, 58.0]*	-2.67 [-4.15, -1.58]	3.0 [1.0, 7.0]*	12.0 [2.0, 34.0]*	<0.001
	More barriers	1 (1.4)	-	-	-	-	-
Deprivation (NZDep score)	Low deprivation (1-3)	22 (31.0)	27.0 [3.0, 52.0]*	-3.35 [-3.95, -2.30]	4.0 [1.0, 8.0]*	19.0 [2.0, 32.0]*	<0.001
	Medium deprivation (4-7)	25 (35.2)	27.0 [6.0, 63.0]*	-3.13 [-4.04, -2.50]	3.0 [2.0, 9.0]*	18.0 [3.0, 34.0]*	<0.001
	High deprivation (8-10)	24 (33.8)	92.0 [45.5, 132.5]*	-2.78 [-3.37, -2.37]	13.5 [6.5, 21.5]*	46.5 [22.0, 63.0]*	<0.001
School Size	Small	21 (29.6)	6.0 [3.0, 32.0]*	-2.50 [-3.81, -1.61]	1.0 [0.0, 4.0]*	3.0 [2.0, 16.0]*	<0.001
	Medium	27 (38.0)	51.0 [25.0, 91.0]*	-3.18 [-4.10, -2.52]	8.0 [2.5, 14.0]*	34.0 [15.0, 47.5]*	<0.001
	Large	23 (32.4)	56.0 [35.0, 106.0]*	-3.10 [-3.56, -2.45]	9.0 [5.5, 20.5]*	31.0 [22.5, 54.5]*	<0.001
Area	Urban	53 (74.6)	40.0 [10.0, 92.0]	-3.13 [-3.94, -2.39]	5.0 [2.0, 14.0]	23.0 [5.0, 47.0]	<0.001
	Rural	18 (25.4)	46.0 [21.0, 104.0]	-2.88 [-3.52, -2.35]	7.5 [3.0, 16.0]	29.5 [8.0, 55.0]	<0.001
School Food Policy	Yes	53 (74.6)	34.0 [10.0, 73.0]*	-3.12 [-3.94, -2.35]	5.0 [2.0, 13.0]	22.0 [5.0, 41.0]*	<0.001
	No	14 (19.7)	61.5 [46.0, 118.0]*	-3.18 [-3.52, -2.46]	8.0 [5.0, 18.0]	37.5 [27.0, 55.0]*	0.001

Abbreviations: HS, health score. NZDep, New Zealand Deprivation Index.

* statistically significant p<0.05 within groups.

† values displayed as median and IQR.

‡ Healthy food outlets defined as having a health score ≥5, unhealthy food outlets defined as having a health score ≤-5. p-values indicate the difference between the amount of

healthy and unhealthy food outlets.

§ Regions have been condensed to accommodate for smaller sample sizes in some regions. Upper North Island combined Auckland and Northland; Central North Island includes Hawkes Bay, Waikato, Taranaki, and Bay of Plenty; Lower North Island includes Manawatu-Whanganui and Wellington; Upper South Island includes Marlborough, Canterbury, and West Coast; and Lower South Island includes Otago and Southland.

| Equity index reported according the Ministry of Education ‘School Equity Index Bands and Groups’, described according to the number of socioeconomic barriers: fewer (344-428), moderate (429-494), and more (495-569).

¶ The New Zealand decile school system, used from 1995 to 2022, ranked schools from 1 (high deprivation) to 10 (low deprivation) based on several socioeconomic variables, with lower decile schools receiving more funding from the Ministry of Education to address educational disparities.

8.4.2.4. Unhealthy food outlets according to demographic variables

The number of unhealthy food outlets around schools varied by NZDep score ($H(2)=10.636$, $p=0.005$), with more outlets in high deprivation areas compared to medium (18 vs. 46.5; $p=0.014$) and low deprivation areas (19 vs. 46.5; $p=0.015$). Schools with a lower EQI score (fewer barriers) also had more unhealthy outlets than those with a medium EQI score (31 vs. 12; $H(2)=10.805$, $p=0.005$; $p=0.007$), while decile rating showed no differences ($H(2)=2.913$, $p=0.233$).

Significant regional differences were observed ($H(4)=27.911$, $p<0.001$), with the upper North Island having more unhealthy food outlets than the central North Island (51 vs. 18; $p=0.006$), upper South Island (51 vs. 12; $p=0.001$), and lower South Island (51 vs. 3; $p<0.001$). School size was also associated with unhealthy food outlet numbers ($H(2)=14.206$, $p<0.001$), with small schools having fewer outlets than medium (3 vs. 34; $p=0.012$) and large schools (3 vs. 31; $p=0.001$).

Higher NZDep score was significantly associated with more unhealthy food outlets ($\chi^2(1)=4.224$, $p=0.040$; $B=0.109$, $SE=0.053$, $p=0.040$), with an 11.5% increase per unit rise in deprivation score. Region was also significantly associated with unhealthy food outlets, with schools in the upper North Island ($\chi^2(1)=6.457$, $p=0.011$; $B=1.231$, $SE=0.485$, $p=0.011$) and lower North Island ($\chi^2(1)=7.437$, $p=0.006$; $B=1.415$, $SE=0.519$, $p=0.006$) having the highest number of unhealthy outlets. Other demographic variables were not significantly associated with unhealthy food outlets.

8.4.3. Food Outlets and School Food Policies

Most (74.6%) schools had a healthy food and drink policy in place, while 19.7% did not. Schools with a healthy food and drink policy had fewer overall food outlets surrounding the school (34 vs. 61.5; $U=506$, $Z=2.083$, $p=0.037$), as well as fewer unhealthy food outlets (22 vs. 37.5; $U=501$, $z=2.007$, $p=0.045$). There were no differences in the food outlet health score based on the presence of a healthy food and drink policy ($U=393$, $z=0.339$, $p=0.734$).

8.4.4. Food Outlet Density and School Canteen Menus

School food menus ($n=71$) were made up of 19.7% 'green' food items, 35.1% 'amber' food items, and 35.5% 'red' food items. The total number of food outlets was not significantly associated with the percentage of 'green' ($\chi^2(1)=3.059$, $p=0.080$; $B=0.127$, $SE=0.085$, $p=0.136$), and 'amber' food items on school canteen menus ($\chi^2(1)=1.261$, $p=0.261$; $B=-0.044$, $SE=0.033$, $p=0.179$). Separate models examining healthy and unhealthy food outlets showed similar patterns, with no significant associations observed between the number of healthy food outlets and the

percentage of 'green' ($\chi^2(1)=1.868$, $p=0.172$; $B=0.524$, $SE=0.383$, $p=0.172$), or 'amber' food items on school canteen menus ($\chi^2(1)=1.737$, $p=0.188$; $B=-0.361$, $SE=0.274$, $p=0.188$). Similarly, unhealthy food outlets were not significantly associated with the percentage of 'green' ($\chi^2(1)=3.607$, $p=0.058$; $B=0.291$, $SE=0.181$, $p=0.107$), or 'amber' food items ($\chi^2(1)=1.364$, $p=0.243$; $B=-0.086$, $SE=0.073$, $p=0.243$). Overall, these findings indicate little evidence of an association between food outlet density or type and the availability of green or amber food items on school canteen menus.

The total number of food outlets surrounding schools showed a small but statistically significant association with the percentage of 'red' food items on school canteen menus ($\chi^2(1)=6.661$, $p=0.010$; $B=-0.127$, $SE=0.049$, $p=0.010$), with higher outlet density corresponding to a slightly lower proportion of 'red' food items. The number of healthy food outlets was also negatively associated with the percentage of 'red' food items on school canteen menus ($\chi^2(1)=3.979$, $p=0.046$; $B=-0.513$, $SE=0.257$, $p=0.046$). The number of unhealthy food outlets showed a small negative association with the percentage of 'red' food items ($\chi^2(1)=4.017$, $p=0.045$; $B=-0.270$, $SE=0.106$, $p=0.011$), suggesting that higher numbers of unhealthy food outlets may be associated with a modest reduction in the proportion of red food items on schools canteen menus. Across all models, effect sizes were small, suggesting limited variation in the proportion of 'red' food items in relation to surrounding unhealthy food outlet density.

8.5. Discussion

The present study utilised Google's Places API to provide a current snapshot of the external food environment around a sample of primary schools across NZ. More than 4,000 food outlets were identified within a 1.6-km catchment area of the 71 schools studied. The average health score across all outlets was -3.12 indicating that unhealthy food outlets significantly outnumbered healthy food outlets around schools, with convenience stores and takeaways/fast food the most prevalent types of food outlets. Results suggest that the current external school food environment is still highly obesogenic and does not promote opportunity for positive nutrition behaviours.

More than 80% of schools in the present analysis had a convenience store and a takeaway/fast food outlet within 1.6-km of the school. This is higher than previously reported in the last national analysis of outlet density conducted in 2014 which showed 68.5% of schools had a convenience store and 62% had a takeaway outlet within the catchment area (Vandevijvere et al., 2016). The high prevalence of convenience stores and takeaway outlets may be attributed to the differences in catchment areas between the two studies, with the last national study using a 800 m school

radius (Vandevijvere et al., 2016). The prevalence and density of convenience stores around primary schools is also likely to contribute to the exposure to unhealthy food advertising. Several studies in NZ have highlighted that most food advertisements, the majority for unhealthy foods such as soft drinks and confectionary, are more likely to be found in and around convenience stores/dairies (Brien et al., 2023; Maher et al., 2005). Children are aware of these advertisements, and in one-on-one interviews with 33 NZ children, many noted that they saw unhealthy food advertisements around their school, and that junk food marketing was effective with many going on to purchase the advertised food (Signal et al., 2019). Despite the high density of unhealthy food outlets near schools, NZ lacks zoning laws that restrict the placement or concentration of these outlets around educational settings (Swinburn et al., 2014).

In the present study, unhealthy food outlets were 2.44 times more frequent around schools in areas of high deprivation compared to schools in the least-deprived areas, consistent with previous findings highlighting food ‘swamps’ in less-affluent areas (Sushil et al., 2017). Similarly, an examination of five NZ cities in 2008 found that the proportion of food outlets was considerably higher around schools in the most-deprived areas with the convenience stores 2.8 times more frequent, and takeaway outlets 2.3 times more frequent in areas of greater socioeconomic deprivation (Day & Pearce, 2011). Trends over time have shown that the median number of fast-food outlets has rapidly increased around more deprived schools in Christchurch, NZ, from one in 1966, to seven in 2006, compared to an increase from one to three around schools in more affluent areas (Day et al., 2015). In NZ, children from the most-deprived areas are 1.35 times more likely to be considered overweight or obese (Ministry of Health, 2024a). The high density of unhealthy food outlets in deprived areas reflects a broader systemic imbalance, where lack of adequate zoning laws and policy are exposing vulnerable populations to obesogenic conditions, likely influencing dietary behaviours, food preferences, and contributing to health disparities (Swinburn et al., 2014).

Given the prevalence of unhealthy food outlets around schools, the role of the school in shaping dietary behaviours is arguably more critical in offsetting the influence from external retailers. Findings from the present analyses suggest that healthy food and drink policies are present in many schools irrespective of the external/surrounding food outlets. While these policies may coincide with more favourable external environments, their existence does not appear to be driven by outlet density or type. Food and nutrition policies can positively influence children’s dietary behaviours in schools and promote healthy school canteens, however, school food policies in NZ are often weak and lack comprehensiveness and strength to make meaningful change (D’Souza et al., 2021; Pledger et al., 2012; Vandevijvere et al., 2019; World Health

Organisation, 2020). Implementing healthy school food policies may be low on the list of school priorities when considering available resources, time, educational demands, and socioeconomic barriers (Ronto et al., 2020; Tipene-Leach & McKelvie-Sebileau, 2021). To bridge this gap, the NZ government, through the Ministry of Education, Ministry of Health, Health NZ and Sport NZ, jointly implemented the HAL initiative to promote healthy eating and physical activity in schools in 2020. A health promotion workforce was deployed to support food policy development, deliver professional development, and engage in strategic planning and collaboration with school boards of trustees and local networks to improve the internal school food environment (Health New Zealand, 2025; Sport New Zealand, 2022). Alongside HAL, the Ministry of Health released the 'Healthy Food and Drink Guidance for Schools', a voluntary traffic-light guidance to promote healthy school canteens (Ministry of Health, 2020b). However, the present analyses highlighted poor implementation of these guidelines with most foods offered within school canteens/tuckshops belonging to the 'red' unhealthy food category (35.5%). 'Green' healthy foods made up the smallest proportion of foods on the school menu (19.7%), consistent with findings from previous studies both in NZ (Green et al., 2025; Pillay et al., 2023b) and Australia (Haynes et al., 2020; Hill et al., 2023; Reilly et al., 2021; Silva-Sanigorski et al., 2011; Woods et al., 2014; Yoong et al., 2015).

While many schools have previously cited the density of food retailers outside the school as a barrier to healthy food provision (Chote et al., 2022; Ronto et al., 2020), the current study found only weak associations between the number of food outlets around the school, whether healthy or unhealthy, and the composition of school canteen menus. No meaningful associations were observed for the proportion of green or amber food items. A small inverse association was observed between food outlet density and the proportion of red food items on school canteen menus, however, effect sizes were small indicating limited practical significance. This suggests that while schools perceive external retailers as a barrier to a healthy school canteen, it is likely that school policies, prioritisation, and funding play a bigger role in the implementation of a healthy school canteen. Successful implementation of healthy food and drink guidelines have been highlighted in areas where guidelines are mandated, with clear expectations and monitoring frameworks in place (Myers et al., 2019; Nathan et al., 2016). Greater investments in initiatives that actively support the internal school food environment, including enhancing the nutrition promotion workforce, mandating healthy food guidelines, and creating accountability measures could have significant impacts on the healthiness of school canteens, challenging the systemic effects of the surrounding obesogenic environment.

8.5.1. Strengths and Limitations

There are several strengths to the present study. The diverse range of schools and national scope across NZ enhances the generalisability of the findings. Our study utilises high resolution mapping using Google's Places API within a 1.6-km radius around each school within the sample. While a secondary measure was not used to validate the data from Google's Places API, studies using Google's geographic database have shown high reliability when compared with ground-truthing (Clarke et al., 2010; Silva et al., 2015), and manual geospatial mapping (Andersen et al., 2021; de Menezes et al., 2021; Ramírez-Toscano et al., 2024). Therefore, the use of Google's Places API is likely to capture a broad range of registered food outlets and may offer more comprehensive coverage than manual data collection alone. Utilising a programming language provides an automated solution that works directly with data provided from Google, and therefore the dataset is entirely replicable with larger sample sizes, enhancing the robustness of the research and opportunities for global comparison. All food outlets were manually categorised, enabling the researcher to override inaccurate Google classifications, for example a 'takeaway' outlet which may have been classified as a 'restaurant' online, as well as remove food outlets which were closed or not applicable to the present analysis. To ensure reliability of the coding, 10% of the dataset was coded independently by two additional researchers, with more than 85% agreement reached. The school canteen menus were analysed by a dietitian, with a second dietitian independently assessing 10% of the menus for reliability and accuracy. The menu analysis toolkit was developed by experts in the field (one dietitian, and three nutritionists) in conjunction with the 'Healthy Food and Drink Guidance for Schools', and has been utilised in recent analyses (Green et al., 2025; Hall et al., 2025; Pillay et al., 2023b).

Several limitations must also be considered in light of the findings. The present study included a convenience sample of 71 primary schools across NZ, which may not be representative of all NZ schools or regions. Additionally, as the sample was limited to primary schools, the findings may not reflect the challenges faced by secondary schools. Excluding nine schools with no food outlets within the catchment area may have biased results toward more food-dense environments and reduced representation of food deserts. Different deprivation measures capture distinct dimensions of inequity and operate at varying spatial and conceptual scales. School-level measures, such as the equity index and school decile, reflect characteristics of the enrolled student population and funding context rather than the surrounding built environment, and may be under-represented in this study due to the exclusion of schools participating in the Ka Ora, Ka Ako/Free and Healthy School Lunch Programme. Divergent associations with food outlet density are therefore not unexpected and likely reflect both these conceptual differences

and the study sample composition. Additionally, as the school menus were self-reported, there is a potential for respondent bias or omission of menus/menu items. Food outlet data was collected at a single point in time, which may not reflect temporal variations such as new store openings or closures, especially in rapidly changing commercial areas. Additionally, Google's Places API only captures food outlets registered on Google which may omit transient or unregistered outlets within the search area. The GLM analyses did not adjust for multiple school-level demographic characteristics simultaneously, and unmeasured or unmodelled may have confounded observed associations between school characteristics and food outlet density. Although all efforts to accurately categorise food outlets were utilised, including Google images, web searches, and social media, manual categorisation of food outlets may have introduced bias in the findings with regards to ambiguous food retailers such as cafés which also provided takeaways. Walking distance has been described anywhere between 200 m to 2 km in the literature, and while a 1.6-km radius was applied to all schools included to identify total number of food outlets, this radius is based on geographic distance, not necessarily utilising a walking path which may be different to actual kilometres travelled by students. Sensitivity analyses using alternative buffer sizes were not conducted, therefore findings may differ if smaller or larger definitions of walkable distance were applied. Furthermore, this study did not examine how the density of food outlets or the composition of school canteen menus translates to actual student purchasing and consumption behaviours which is a valuable direction for future research and could provide further insights into the individual implications of obesogenic environments.

8.6. Conclusion

Our findings indicate that the food environment surrounding NZ primary schools is suboptimal, with a high density of unhealthy food outlets, especially in areas of greater socioeconomic deprivation, contributing to an increasingly obesogenic environment. There was only weak association between external food outlet density and the composition of school canteen menus suggesting that school-level factors such as policy strength, prioritisation of healthy food and drink, and funding are likely to play a more important role in the composition of school canteen menus. Health promotion initiatives like HAL, have the potential to improve the school food environment but requires larger investment in the health promotion workforce and greater government support. To support healthier nutrition behaviours among children, efforts should focus on implementing robust internal school food policies, as well as exploring wider systemic interventions such as zoning regulations to limit children's exposure to unhealthy food environments.

Chapter 9

General Discussion and Conclusions

This chapter discusses key findings and presents the overall conclusions of the PhD study. It draws together insights from all chapters, summarising the results in relation to each research question outlined in Chapter 1.3. The chapter also highlights the novel contributions of the research, acknowledges its strengths and limitations, and identifies opportunities for future directions and policy change.

9.1. Summary of Key Findings

The overall aim of this thesis was to critically examine the healthiness of primary school food environments in NZ, by investigating how national guidance, school-level policies and practices, and surrounding foodscapes influence school food provision. Two reviews of the literature were conducted: one assessing the current NZ food landscape, and the other assessing the impact of national food and drink guidelines on the healthiness of school canteens across NZ and Australia. To assess the impact of the new 'Healthy Food and Drink Guidance for Schools', canteen menus were assessed in a convenience sample of primary schools across NZ at the introduction of the guidance, as well as three years later. School food practices, reported barriers, and the presence and impact of the school-based food and nutrition policies on healthy food availability was also assessed. The impact of the surrounding retail food environment around schools on the healthiness of school food availability was investigated to identify barriers to national and school-level policy implementation. A summary of the key findings, with their relevance to the four research questions, outlined in Chapter 1, section 1.2, established for this PhD study are outlined below:

1. What influences the healthiness of school food environments in New Zealand, both within schools and in the surrounding communities?

The healthiness of school food environments in NZ is influenced by a range of factors both within schools and in their surrounding communities. Internally, many schools lack comprehensive nutrition policies and have limited accountability measures and incentives to enable schools to prioritise healthy canteens within a time-scarce and resource-poor education system. Mandating the guidance, creating a monitoring framework, and providing additional support for schools could help with greater implementation. Externally, the local food environment, including the density of unhealthy food outlets and food advertising, may undermine the school's effort to promote healthy eating and discourage change. Socioeconomic factors such as food insecurity, food 'swamps'⁵, and access to healthy food significantly influence the healthiness of school food environments and disproportionately affect the most vulnerable communities in NZ.

⁵ Food 'swamps' are a spatial metaphor to describe neighbourhoods where fast food and junk food inundate healthy alternatives.

2. How effective are national food and drink guidelines on improving the healthiness of school food provision, and what are the barriers and enablers to successful implementation?

The influence of national food and drink guidelines on school food provision was examined through an integrative review of 25 studies from both NZ and Australia. While limited data exists in the NZ context (n=2 of 25 included), many Australian states use a traffic-light system in their state-specific school food guidelines and operate school food provision systems similar to NZ allowing comparability. However, despite many years of implementation in Australian schools, there was low compliance with school food guidelines and significant socioeconomic disparities. Barriers to implementation included socioeconomic deprivation, variability in school guidelines and classification of foods e.g. what counted as a sugary drink, and lack of monitoring measures. Enablers for implementation included clear targets, monitoring systems and feedback models through external support systems, and incentivisation schemes.

3. To what extent do New Zealand primary school canteen menus meet the national 'Healthy Food and Drink Guidance for Schools'?

A convenience sample of 133 primary school canteen menus were assessed against the Ministry of Health 'Healthy Food and Drink Guidance for Schools' at the time of its introduction. Menu items were categorised according to the traffic-light classification criteria set in the guidance. Results showed that 41% of menu items belonged to the moderate nutritional value 'amber' category, and 40% in the low nutritional value 'red' category. Healthy 'green' food items made up 12.8% of school menus, considerably lower than the recommended 75% target. The most common menu constituents were sandwiches (86%), followed by baked food items (including pies and sausage rolls, 71%). Sugar-sweetened beverages were just as prevalent as water in school menus. Three years later, 89 schools from the original convenience sample provided updated menus to assess the level of guidance implementation. There was a similar distribution of 'green', 'amber', and 'red' foods across menus. However, although not statistically significant, 'green' menu items increased from 15.5% to 21.2% ($p=0.117$); 'amber' items decreased from 44.4% to 33.8% ($p=0.005$), while 'red' items showed minimal change (35.4% to 37.5%; $p=0.079$). A qualitative assessment of foods available highlighted a decrease in less healthy options with sugary drinks reduced from 40% to 31%, and ultra-processed savoury snacks from 42% to 33%, showing overall positive trends despite persistent high prevalence of 'red' food items from the introduction of the guidance to three-years later.

4. How do school-level policies, perceived barriers, and the surrounding food environment influence the nutritional quality of foods available in New Zealand primary school canteens?

In a convenience sample of 80 schools, there were no differences in the percentages of ‘green’, ‘amber’, and ‘red’ food items between schools that had a healthy food and drink policy and those that did not. There was also no association between having a ‘plain milk and water only’ policy and the presence or absence of sugar-sweetened or red-classified beverages. More than a third (38.9%) of menus from schools that stipulated ‘plain milk and water only’ still contained sugar-sweetened or ‘red’-classified beverages. The number of reported barriers was not a significant predictor of the presence of a food policy (OR=1.034, $p=0.841$), nor was it a predictor of ‘green’, ‘amber’, and ‘red’ food items. The results presented in Chapter 7 highlight that school food policies are not implemented effectively and are contradictory to foods offered in school canteens. Additionally, the external food environment around these schools was highly obesogenic with an average of 45 food outlets around each school with a median health score of -3.12⁶. Unhealthy food outlets dominated the surrounding foodscape with 3.8 times more unhealthy food outlets compared to healthy outlets ($p<0.001$). However, while there needs to be greater zoning regulations to prevent unhealthy food outlet exposure around schools, the results presented in Chapter 8 illustrated a weak association between types and density of external food outlets and the healthiness of school canteen menus. The total number of food outlets around schools was a small but significant predictor of red food items on school canteen menus ($\chi^2(1)=6.661$, $p=0.010$; $B=-0.127$, $SE=0.049$, $p=0.010$), suggesting that as total food outlets increase, the percentage of red food items slightly decreases. However, this finding was associated with a small effect size indicating limited real-world impact. The findings suggest that school canteens currently operate independently of the surrounding foodscape and change to school food availability is within the scope of the school itself through the development and implementation of meaningful, actionable, and individualised school food and nutrition policies.

⁶ Health scores were adapted for use from the ‘Food Environment Score’ tool which utilised a score between -10 and 10 to classify the healthiness of food outlets. A negative score described unhealthy food outlets, and positive scores described healthy food outlets.

9.2. Discussion of Main Findings

The investigation into the healthiness of the primary school food environment in NZ highlighted major gaps in school food and drink policy implementation and compliance with national government guidelines.

This thesis presents the first national analysis of the healthiness of primary school canteen menus in accordance with the 'Healthy Food and Drink Guidance for Schools' implemented in 2020 by the Ministry of Health alongside the Healthy Active Learning initiative. However, results reported in Chapters 5 – 8 highlight poor compliance to the guidance with the lowest proportion of foods belonging to the healthy 'green' category (12.8 – 16.4%), and the majority of available foods belonging to the less healthy 'amber' (34.7 – 41%) or unhealthy 'red' (36.8 – 40%) food categories. The new guidance is not the first classification system implemented in NZ to help promote healthy food availability. Between 2007 and 2019, schools were encouraged to utilise the Food and Beverage Classification System (FBCS) to promote healthy food and drinks for all students (D'Souza et al., 2021; Gorton et al., 2009; Vandevijvere et al., 2018a). This system used a similar 3-tier classification system which categorised foods as 'everyday', 'sometimes', and 'occasional'. The INFORMAS study conducted a national analyses of foods for sale across 423 primary schools in NZ from 2014-2017 and, similar to the findings in this thesis, reported 26.2% 'everyday' foods, with 58.2% 'occasional' foods available in schools (Vandevijvere et al., 2018a). Findings suggest therefore that guidance alone is ineffective, and stronger implementation strategies are warranted.

The National Administration Guidelines created in the early 1990s were updated in 2009 following a change in government and removed the requirement for 'only' healthy food and drinks to be available within schools which undermined efforts to prioritise healthy food environments (Gorton et al., 2009). Although these guidelines were ceased in 2023, the NZ Education (School Boards) Amendments Regulations 2022 still require Boards of Trustees to promote healthy food and nutrition to all students (Ministry of Education, 2022a). Despite this, findings reported in Chapter 6 highlight that over a three-year implementation period, there were no significant changes in the percentage of 'green' or 'red' items on a school canteen menu following the introduction of the 'Healthy Food and Drink Guidance for Schools'. These analyses provide a novel contribution to the body of evidence as this is the first longitudinal study to examine the implementation of the guidance in NZ. As both the FBCS and new guidance are voluntary and monitoring and accountability measures are lacking it is not surprising that uptake is poor despite nearly two decades of national school guidelines. In Australia several states have adopted similar

traffic-light guidelines for schools (Rosewarne et al., 2020), yet levels of compliance are only observed to be higher in Western Australia where school guidelines are mandated with clear and stringent targets, and principals are required to submit annual reports on the healthiness of school canteens to the relevant government organisations (Myers et al., 2019).

Without sufficient incentives, healthy food and drink policies in schools become a ‘tick-box’ activity among other competing priorities, with many schools often sourcing pre-made templates that lack individualisation, comprehensiveness, and strength from websites such as SchoolDocs (D'Souza et al., 2021; SchoolDocs, 2025; Vandevijvere et al., 2018a). This is highlighted from the findings reported in Chapter 7 which demonstrated that healthy food and drink policies within schools had no effect on the healthiness of the foods available to purchase ($p>0.05$). As the first study to examine the impact of school-based food and drink policies on canteen food availability in NZ, this provides a novel contribution to the evidence. Since 2016, the Ministry of Health has encouraged schools to adopt ‘plain milk and water only’ policies to promote healthy habits and this has been continued in the updated guidance (Ministry of Health, 2020b; Vandevijvere et al., 2018a). However, findings in this thesis showed that more than a third of canteen menus from schools that stated they had a ‘plain milk and water only’ policy still contained sugar-sweetened or ‘red’ classified beverages suggesting that school-level policies in isolation have limited power. Barriers to promoting a healthy food environment within schools have been explored previously with findings consistent with those reported in Chapter 7 highlighting that the convenience of ready-made food and drinks, and resistance from parents are competing interests (Chote et al., 2022; D'Souza et al., 2021; Ronto et al., 2020). However, results of this thesis show no significant difference in the healthiness of foods available in school canteens between schools that reported barriers and those that did not, highlighting a disconnect between perceived challenges and actual outcomes.

In NZ, evidence suggests that school canteen menus are sometimes shaped by the surrounding retail environment, with some schools opting to offer less-healthy foods to remain competitive with nearby outlets (Coady et al., 2025). Lack of zoning laws in NZ mean that schools are surrounded by food retailers and food advertising, much to their detriment with greater consumption of unhealthy snack foods and soft drinks on school days (Day et al., 2015; Situmorang et al., 2024; Vandevijvere et al., 2016). In the first analysis to examine the relationship between the external retail food environment and school food provision in NZ, Chapter 8 showed an average of 45 food outlets around schools, with a health score averaging -3.12. Unhealthy food outlets dominated the external foodscape with four unhealthy food outlets for every one healthy outlet. Despite this, the number of outlets, whether healthy or unhealthy, was not significantly

associated with the percentage of ‘green’, ‘amber’, or ‘red’ foods on school canteen menus. This suggests that school canteens can operate independently of their surroundings and provides an important context for future school policies and planning.

9.2.1. Updates on the New Zealand school food landscape

Since the completion of the narrative review in 2021 (Chapter 2), several significant policy and contextual changes have occurred in NZ that are likely to influence the school food environment and provide important context for interpreting the findings of this thesis. The COVID-19 pandemic had a significant negative effect on household food insecurity in NZ (Tipene-Leach & McKelvie-Sebilleau, 2021), with the government responding by scaling up the ‘Ka Ora, Ka Ako’ Free and Healthy School lunch programme to support students and families facing greater hardship during this time (Ministry of Education, 2022b). While this programme has increased access to food for many students, recent changes following a shift in government have prioritised cost-efficiency and modified delivery models leading to ongoing uncertainty regarding its long-term structure, and raising concerns regarding the nutritional quality of foods provided to students (Mejía Toro et al., 2025).

At the same time, policy changes to improve the healthiness of school food environments have been limited. The introduction of the Education (School Boards) Amendment Regulations 2022 reinforced the requirement for schools to promote healthy food and nutrition, however, this remains largely voluntary without monitoring or accountability measures (Ministry of Education, 2022a). Recent assessments of policy implementation in NZ continue to highlight that NZ has significant gaps in the implementation of healthy food policies in schools, marketing restrictions for children, and food outlet exposure near schools (Mackay et al., 2023).

9.2.2. Policy and practice implications

Targeted school food and nutrition policies have been shown to increase fruit and vegetable consumption, reduce intake of sugar-sweetened beverages, and reduce intake of unhealthy snacks in children (Micha et al., 2018). Schools have an opportunity to create healthy food environments for children, however, school food policies alone fail without structural and system-level change. Several Australian studies have highlighted that multicomponent interventions which include staff training, performance monitoring, feedback and ongoing support can improve schools’ implementation of healthy canteen policies (Nathan et al., 2016; Reilly et al., 2018; Wolfenden et al., 2017; Yoong et al., 2016). These interventions are also highlighted in external support services offered in NZ schools including the Heart Foundation

Healthy Heart Award and *Heart Start Toi Toi Manawa* which incentivised schools to create healthier school canteens. The Heart Foundation *Healthy Heart Award* led to schools improving food availability in their canteens in order to achieve the award, which then led to reduced sales of unhealthy foods (Carter & Swinburn, 1999; Gerritsen et al., 2017). Similarly, the *Heart Start Toi Toi Manawa* programme, which was comprised of curriculum-linked modules to help create healthier canteens, led to greater uptake of food policies, and healthier food availability in school canteens (Soupen et al., 2017).

This thesis examined the impact of the Healthy Active Learning initiative, a joint government initiative launched in 2020 by Sport NZ, the Ministry of Education, the Ministry of Health, and Health NZ to support schools in improving children's wellbeing through healthy eating and drinking, and physical activity (Sport New Zealand, 2022). A nutrition workforce was deployed through the National Public Health Service to support schools to create healthy food and drink environments. However, staff redeployment during the COVID-19 pandemic and limited funding for the nutrition workforce likely contributed to the low uptake of the guidance and minimal improvements in food availability in the schools assessed in this thesis. Additionally, the nutrition workforce was regionally based and governed resulting in fragmented delivery and inconsistent nutrition education and promotion across schools which may have hindered progress despite participation in Healthy Active Learning. From previously reported literature and findings reported in the present thesis it is clear that schools face numerous barriers to implementing a healthy school canteen (Coady et al., 2025; Ronto et al., 2020; Walton et al., 2010) and external support services are needed. However, when it comes to health and educational outcomes support services need to be consistent, with clear targets and accountability measures to ensure there is a return on investment.

In addition to the health promotion workforce, the implementation of a voluntary national guidance without a monitoring and accountability framework was likely to have led to reduced uptake, as demonstrated in both NZ (Carter & Swinburn, 2004; D'Souza et al., 2021) and Australian settings (Haynes et al., 2020; Hill et al., 2023; Myers et al., 2019; Reilly et al., 2021) as well as reflected in the findings of this thesis. While state-specific guidelines are mandated in Australia (Rosewarne et al., 2020), there is still variable uptake which suggests that mandating national guidelines is not enough to elicit change. Western Australia has higher levels of compliance with mandatory state-specific guidelines which may be attributed to the requirement for school principals to submit an annual canteen report each year to the relevant governing body (Myers et al., 2019). While other states like NSW and Queensland have tried this, albeit on a voluntary basis, they did not show the same levels of compliance (Clinton-McHarg et al., 2018;

Haynes et al., 2020) suggesting that national guidelines should be mandatory and include effective compliance monitoring.

Schools have demonstrated that they can operate independently of the external retail environment which is encouraging for future initiatives aimed at strengthening healthy food and drink policies and ensuring adherence to national guidance. While findings in this thesis did not show an association between the external retail food environment and school food availability or school food policies, there is still significant work to be done to create healthier food environments around schools. NZ falls short of international best-practice when it comes to zoning laws and limiting children's exposure to unhealthy food retailers and advertising (Mackay et al., 2020). Several countries including South Korea and Ireland, and some states within the USA, have implemented zoning laws to prohibit sales of unhealthy foods like fast foods and soft drinks within a defined radius around schools (Swinburn et al., 2014). However, results reported in Chapter 8 noted an average of 23 'unhealthy' food outlets out of a total of 45 outlets on average within a walkable 1.6-km radius around primary schools. Although the density of food outlets around schools may not directly affect internal school food availability, it can undermine healthy food policies and nutrition initiatives, highlighting the need for stronger regulatory measures.

9.2.3. Equity considerations

There were clear socioeconomic differences in the availability of healthy foods in school canteens reported in this thesis. At the introduction of the guidance in 2020, schools in the most deprived areas, categorised by low decile levels⁷, low NZ deprivation scores⁸, and high equity index⁹ scores had fewer healthy 'green' food items on the school compared to schools in more affluent areas. Similarly, low decile schools had a higher proportion of 'red' food items compared to their high decile counterparts. No significant changes were noted between baseline and three-year follow-up likely due to the reduced sample of schools from higher deprivation areas because of recruitment into the free 'Healthy School Lunches Programme'. These school-level patterns

⁷ The NZ decile school system, used from 1995 to 2022, ranked schools from 1 (most deprived) to 10 (least deprived) based on several socioeconomic variables, with lower decile schools receiving more funding from the Ministry of Education to address educational disparities.

⁸ The 2023 NZ Deprivation Index (NZDep), an area-based measure of socioeconomic deprivation, was used to determine schools' deprivation levels. NZDep scores were classified as low deprivation (NZDep 1-3), medium deprivation (NZDep 4-6), or high deprivation (NZDep 7-10).

⁹ In 2023, the decile system was replaced by the Equity Index (EQI), which considers a broader range of socioeconomic factors with higher scores indicating greater need for additional support and funding.

reflect broader dietary inequities observed nationally. Annual health data for 2024/25 in NZ highlights that children under the age of 15 living in the most deprived areas are 2.33 times more likely to have fast food more than three times a week and 2.47 times more likely to have fizzy drinks more than three times per week compared to those in the least deprived areas (Ministry of Health, 2025). Similarly, children living in the most deprived areas were less likely to meet their fruit and vegetable recommendations and have a daily breakfast compared to those in more affluent areas (Ministry of Health, 2025).

There are significant nutrition disparities in NZ which are further compounded by household food insecurity, food ‘swamps’, and lower access to healthy and affordable foods (Ministry of Health, 2025; Sawyer et al., 2021; Sushil et al., 2017). Findings reported in Chapter 8 further demonstrate there are significantly more retail food outlets around schools in areas of greater socioeconomic deprivation, with 3.4 times the amount of total food outlets and more than double the amount of unhealthy food outlets compared to schools in affluent areas. These results are consistent with previous studies in NZ highlighting an ongoing equity issue (Sawyer et al., 2021; Sushil et al., 2017; Vandevijvere et al., 2016). Exposure to unhealthy food advertising and external retailers has been shown to influence children’s purchasing and consumption behaviours. A study using wearable-cameras showed that unhealthy foods were significantly more prevalent in convenience stores visited and dominated the purchases of students (McKerchar et al., 2020). Findings from another wearable-camera study in NZ suggested that the types of foods and beverages children consume on school-days reflect what is available to them (Smith et al., 2019). Additionally, the density of food outlets is correlated with a greater proportion of unhealthy food advertising to children which can negatively influence food choices and preferences during formative years (McKerchar et al., 2020; Sadeghirad et al., 2016; Vandevijvere et al., 2018b). Equity remains a challenge in achieving healthy food environments for all children. Despite national guidance, structural barriers such as socioeconomic deprivation, food retail density, and household food insecurity continue to shape school food environments and dietary behaviours. Tackling these inequities requires moving past isolated school-based policies toward comprehensive interventions that address the structural disadvantages of these school communities (Hobbs et al., 2019).

9.3. Strengths and Limitations

This thesis presents the first analysis of primary school canteen menus in accordance with the ‘Healthy Food and Drink Guidance for Schools’ and is the first to assess the connection between both the internal and external food environment on the healthiness of school canteens in NZ. The

strengths and limitations for the research conducted in this PhD project are discussed in detail in each empirical chapter. A summary of key strengths and limitations are included below:

- Menu analysis was completed across the thesis by one registered dietitian, with coding reliability assessed by second dietitian familiar with the dataset and menu analysis toolkit ensuring consistency and accuracy in classification, however, menus were self-reported by schools therefore there is potential for respondent bias or omission of menus/menu items. A menu analysis toolkit, a type of quick menu audit tool which has been recognised as a reliable means of evaluating canteen compliance with healthy food and drink policies (Reilly et al., 2016), was developed and coded by one dietitian and three nutritionists, ensuring nutritional accuracy of the coding in accordance with the 'Healthy Food and Drink Guidance for Schools'. However, some school canteen menus lacked detail therefore assumptions needed to be made regarding their categorisation according to the 'Healthy Food and Drink Guidance for Schools' which may have influenced results, particularly for mixed meals and sandwich-based lunch options. A list of assumptions was created to ensure consistency across menu items (Appendix 9).
- In Chapters 5 and 6, findings show a low response rate in comparison to the total number of primary schools across NZ (6.8%) which may have been exacerbated by the COVID-19 pandemic impacting HAL evaluation data collection. Most schools in areas of high deprivation were recruited into the free school lunch programme during the research study period which led to the discontinuation of school canteens and contributed to a suboptimal attrition rate for follow-up analyses (67% attrition rate, 4.6% of all NZ primary schools). As a result, low decile schools were under-represented in the follow-up analysis. Similarly, findings reported in Chapter 7 showed a low response rate which may limit the generalisability of the results (12.4% for the survey, 4.1% for the menus). Due to factors outside the control of the PhD candidate, school-based food and nutrition policies were not collected / available to review therefore the strength and comprehensiveness of food policies could not be determined in relation to school food availability which could have strengthened the results.
- The nutrition workforce for HAL encountered significant challenges during the evaluation period which may not be reflective of the potential impact of the programme. The study did not include direct measurement of the nutrition workforce's role in supporting school policy implementation due to limitations in evaluation design and governance structures which may have provided further insights into the limited change over the three-year follow-up period. Additionally, the impact of the COVID-19 pandemic may have

influenced the implementation of the national guidance due to competing priorities, potentially confounding the results.

- The external food environment dataset reported In Chapter 8 was collected in a robust and entirely replicable way using Google's Places API, which guarantees all food outlets are captured in comparison to using manual data collection measures. However, food outlet data was collected at a single time point which may not reflect temporal variations such as new store openings or closures, especially in rapidly changing commercial areas. Google's Places API captures only registered business addresses which may omit transient or unregistered outlets within the search area, however, all food outlets were manually categorised, enabling the researcher to override inaccurate Google classifications, as well as remove outlets which were closed or not relevant to the analysis. Reliability in the coding was completed with 10% of the dataset coded independently by two additional researchers.

9.4. Policy Recommendations

In light of these findings, several policy recommendations are proposed to strengthen the nutritional quality and equity of primary school food environments, enhance policy compliance and accountability, and address structural barriers to healthy food provision.

- Mandate the 'Healthy Food and Drink Guidance for Schools' for all primary schools.
- Reinstate the requirement for schools, where applicable, to make 'only' healthy food and drinks available in school canteens.
- Introduce compliance monitoring and reporting with clear targets and accountability measures and mandate annual canteen reports from primary school principals to demonstrate adherence.
- Scale up incentivisation schemes which promote healthy school food practices and food availability and create positive reinforcement for schools to continue to implement healthy practices.
- Create a consistent intervention framework for nutrition health promoters and robust evaluation processes to assess impacts. Provide additional resources and work collaboratively with schools in high-deprivation areas to overcome structural barriers.
- Introduce zoning laws to limit unhealthy food retailers and advertising within a defined radius around schools especially in low socioeconomic areas.

These recommendations may carry several associated costs which should be considered. Firstly, there are direct financial costs, particularly for monitoring and enforcement. For example,

implementing mandatory compliance reporting and annual canteen audits would require personnel, administrative infrastructure, and potentially new systems at both school and government levels. Secondly, there are costs to schools themselves. Schools may need to modify menus, retrain staff, or change suppliers to meet stricter nutrition standards. In some cases, healthier food options can be more expensive or less profitable, which could affect canteen revenue streams. Thirdly, there are opportunity costs. School leadership and staff time spent on compliance, reporting, and implementation may take time away from other educational priorities. There are also political and commercial costs. For example, zoning laws restricting unhealthy food outlets around schools may face resistance from businesses and require significant regulatory effort and enforcement. Importantly, some costs may disproportionately affect schools in lower socioeconomic areas, which may already face resource constraints. However, this is why the recommendation includes additional support and targeted resourcing to mitigate those inequities. Overall, while these policies involve upfront and ongoing costs, they need to be weighed against the long-term benefits, including improved child health outcomes, reduced health inequities, and potential downstream savings in healthcare expenditure.

9.5. Future Directions

The results found in this PhD research highlight several areas for future research to expand and strengthen the evidence for improving school food environments in NZ.

1. Replicating this research with a larger sample of primary schools over repeated intervals is recommended to enhance robustness and generalisability, as well as allow changes over time to be examined. Additionally, assessing the strength and comprehensiveness of school food and drink policies in relation to the availability of healthy foods would provide deeper insights and help strengthen the findings of the present research.
2. Key stakeholder interviews and qualitative analysis could provide valuable context to the findings of this thesis. Engaging stakeholders such as school principals, canteen operators, and food service providers may uncover barriers to implementing healthy food and drink environments not captured in the present research. Similarly, exploring schools' understanding of healthy food and drink policies, their interpretation of national guidance, and the types of support they consider most useful would offer insights to inform future policy action.
3. Future research could explore interventions within the school canteen that goes beyond policy adoption to actively influence purchasing behaviours. These could include pricing

strategies, marketing techniques, and peer modelling to provide evidence for practical and scalable solutions to create healthier food environments.

4. Evaluating food availability in relation to student purchasing and consumption behaviours is essential to understand the potential impact of improving the healthiness of school canteens in NZ. Further research should also examine how the density of food outlets around schools influence children's purchasing and consumption patterns, using methods such as diet recalls or wearable-cameras, to provide stronger evidence for zoning laws. In addition, conducting parallel studies with NZ that compare the impact of zoning regulations in other countries could help build a compelling case for policy change.
5. Future research should also focus on evaluating strategies that strengthen school food environments. Conducting a randomised controlled trial in NZ to assess the impact of a multicomponent intervention combining support, resources, monitoring, feedback, and recognition on school food availability and adherence to national guidance could provide further evidence to support future health improvement initiatives.

9.6. Concluding Remarks

This is the first national and longitudinal analysis to assess compliance of primary school canteen menus to the 'Healthy Food and Drink Guidance for Schools' in NZ, alongside a novel investigation of the impact of food policies, reported barriers, and the external food environment on healthy school food availability. Findings show that compliance with national guidance in NZ primary schools remains low, with most canteen menu items belonging to the less-healthy 'amber' or unhealthy 'red' categories, and minimal improvement over a three-year implementation period. School-level policies showed no significant impact on food availability. Reported barriers and the external retail foodscape did not significantly impact school canteen menus suggesting that perceived challenges may not translate into actual food availability. This suggests that schools have the capability to improve their food environments when provided with the right support and resources. Socioeconomic disparities persist with schools in high-deprivation areas offering fewer healthy options and facing greater exposure to unhealthy retail environments. These findings highlight that voluntary guidance and school-level policies alone are insufficient, and reinforce the need for consistent implementation support, mandatory national guidance, and clear and robust monitoring frameworks to ensure equitable access to healthy school food environments for children.

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Appendix 1: Ethics Approval for the Healthy Active Learning Evaluation



Date: 07 April 2020

Dear A/Pro Aj Ali

Re: Ethics Notification - **NOR 20/07 - Evaluation of Healthy Active Learning (HAL)**

Thank you for the above application that was considered by the Massey University Human Ethics Committee: **Human Ethics Northern Committee** at their meeting held on **Tuesday, 7 April, 2020**.

On behalf of the Committee I am pleased to advise you that the ethics of your application are approved.

Approval is for three years. If this project has not been completed within three years from the date of this letter, reapproval must be requested.

If the nature, content, location, procedures or personnel of your approved application change, please advise the Secretary of the Committee.

Yours sincerely

Professor Craig Johnson
Chair, Human Ethics Chairs' Committee and Director (Research Ethics)

Research Ethics Office, Research and Enterprise

Massey University, Private Bag 11 222, Palmerston North, 4442, New Zealand T 06 350 5573; 06 350 5575 F 06 355 7973
E humanethics@massey.ac.nz W <http://humanethics.massey.ac.nz>

From: Human Ethics
Sent: Thursday, 9 March 2023 4:39 pm
To: Ajmol Ali; Human Ethics
Subject: Minor amendment to ethics application NOR 20/07 - Approved

Importance: High

Minor Amendment to a previously approved application

Thank you for your email dated 28 February 2023 outlining the change(s) you wish to make to the above application.

The change(s) were approved and noted, as follows:

Ethics approval extended until 30 September 2025.

If the nature, content, location, procedures or personnel of your approved application change, please advise the Secretary of the Committee. If over time, more than one request to change the application is received, the Chair may request a new application.

Appendix 2: Chapter 2 Additional Files

2.1. Statement of Contribution


MASSEY
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 UNIVERSITY OF NEW ZEALAND

**GRADUATE
RESEARCH
SCHOOL**

STATEMENT OF CONTRIBUTION

DOCTORATE WITH PUBLICATIONS/MANUSCRIPTS

We, the student and the student's main supervisor, certify that all co-authors have consented to their work being included in the thesis and they have accepted the student's contribution as indicated below in the Statement of Originality.			
Student name:	Danika Pillay		
Name and title of main supervisor:	Professor Ajmol Ali		
In which chapter is the manuscript/published work?	Chapter 2		
Describe the contribution that the student and members of the supervisory team have made to the manuscript/published work: ¹			
Danika designed and conceptualised the review, completed the literature search, and wrote the paper. Supervisors Prof. Ajmol Ali and Prof. Carol Wham assisted in the conceptualisation of the review and edited and reviewed the final version.			
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2.2. Journal Publication

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Examining the New Zealand school food environment: what needs to change?

Danika Pillay*, Ajmol Ali and Carol A. Wham

School of Sport, Exercise and Nutrition, Massey University, Auckland, New Zealand

Abstract

Habitual dietary intakes and nutrition behaviours developed during childhood and adolescence pave the way for similar behaviours to manifest in adulthood. Childhood obesity rates have now reached a point where one in six children globally are classified as overweight or obese. Schools have the unique ability to reach almost all children during key developmental stages, making them an ideal setting for influencing children's nutrition behaviours. Evidence suggests the school food environment is not always conducive to healthy food choices and may be obesogenic. The aim of this narrative review is to explore factors that influence the healthy food and drink environment in and around schools in New Zealand. The review focused on evidence from New Zealand and Australia given the close resemblance in education systems and school food guidance. Using the Analysis Grid for Environments Linked to Obesity (ANGELO) framework, the school food environment was categorised into the following domains: economic, political, physical and socio-cultural factors. Findings suggest that food policies are not utilised within schools, and guidelines to improve the school food environment are not well implemented. Canteen profit models, lack of staff support and resources, and higher availability of low-cost unhealthy foods are among barriers that hinder implementation. This review highlights recommendations from existing evidence, including canteen pricing strategies, restriction of unhealthy foods and using peer modelling in a time-scarce curriculum to improve the school food environment. Key areas for improvement, opportunities to enhance policy implementation and untapped avenues to improve the food and nutrition behaviours of children are highlighted.

Keywords: School food policy: Canteen: Food availability: Childhood nutrition: Health promotion: Barriers: Nutrition education

(Received 23 February 2022; revised 23 June 2022; accepted 11 August 2022; accepted manuscript published online 15 August 2022)

Childhood obesity, unhealthy diets and physical inactivity have strong linkages with the development of non-communicable diseases, and are associated with higher economic burden on the health care sector⁽¹⁾. In New Zealand, one in three children aged between 2 and 14 years are classified as overweight or obese compared with one in six globally^(2,3). Ethnic disparities also exist within New Zealand, with Māori and Pacific children more likely to be overweight and obese compared with non-Māori and non-Pacific children⁽²⁾. There is a complex relationship between childhood obesity, health, and educational outcomes, particularly when accounting for the non-BMI-related factors, such as physical activity and nutrition, and the food environment^(4–6). Dietary habits established during childhood and adolescence are known to influence behaviours in adulthood and may impact health later in life, making it an issue that warrants policy action^(7,8). Intervention approaches that exclusively target individual-level determinants such as knowledge, beliefs and habits have little or no impact long term^(9,10). However, in combination with environmental-change components these individual approaches have greater effectiveness in improving health behaviours^(10,11).

The school food environment provides an opportunity for public health interventions to improve the health of children⁽¹²⁾. In New Zealand, school enrolment is compulsory for children aged between 6 and 16 years⁽¹³⁾. As a result, primary and

secondary schools have the ability to reach almost all children and young people during the first two decades of their lives, making them an ideal setting for influencing children's nutrition and physical activity behaviours⁽¹⁴⁾. The school food environment refers to all spaces in and around schools where food is made available and consumed, and represents an effective setting to influence children's food choices⁽¹⁵⁾. In New Zealand, food is usually brought from home and/or bought at school. From data collected in the 2002 New Zealand National Children's Nutrition Survey, more than half of all students (58%) bought some or most of their food and drink from the school canteen⁽¹⁶⁾. School food provision varies, with some schools providing in-house catering to their canteens, some outsourcing to external catering companies and food providers, and some having a combination of both. Previous mandated legislation sought to improve the food environment within schools; however, the requirements for 'only healthy food options to be sold on school premises' was removed following a change in government in 2009^(17,18). Since then, the onus has been put onto the schools' Board of Trustees to mandate healthy food and drinks within schools^(17,18). Prior to the introduction of the Healthy Food and Drink Guidance for Schools in 2020, schools had been using the Food and Beverage Classification System to help them to make decisions about which foods to provide within

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Appendix 3: Chapter 3 Additional Files

3.1. Statement of Contribution

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STATEMENT OF CONTRIBUTION
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Name and title of main supervisor:	Professor Ajmol Ali		
In which chapter is the manuscript/published work?	Chapter 3		
Describe the contribution that the student and members of the supervisory team have made to the manuscript/published work: ¹ Danika designed and conceptualised the review, completed the literature search, and wrote the paper. Supervisors Prof. Ajmol Ali and Prof. Carol Wham assisted in the conceptualisation of the review and edited and reviewed the final version.			
Please select one of the following three options:			
☒	The manuscript/published work is published or in press Please provide the full reference of the research output: Pillay, D., Ali, A., & Wham, C. (2024). The effect of healthy food guidance for schools on food availability, purchasing and consumption among school children in New Zealand and Australia: an integrative review. Nutrition Research Reviews, 1 – 15. doi:10.1017/S0954422424000362		
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Keywords:

childhood nutrition; enablers and barriers; health promotion; school canteen; school food policy

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The effect of healthy food guidance for schools on food availability, purchasing and consumption among school children in New Zealand and Australia: an integrative review

Danika Pillay , Ajmol Ali and Carol Wham 

School of Sport, Exercise and Nutrition, Massey University, Auckland, New Zealand

Abstract

Modifying the food environment holds promise for instilling healthier behaviours in children and may be an effective public health strategy for preventing childhood obesity and adverse health outcomes. The school food environment is a valuable setting to influence most children's dietary behaviours from an early age, yet evidence suggests that the New Zealand and Australian school food environment is not conducive to healthy food and drink consumption. The present study aimed to investigate the level of compliance in New Zealand and Australia with government guidelines for food and drink availability within schools and the subsequent effect on food consumption and purchasing behaviours of children. A systematic review utilising three databases, PubMed, Scopus and the Cochrane Library, was conducted. The research covered peer-reviewed studies from both New Zealand and Australia that met predefined inclusion criteria. Fifteen studies focused on assessing food availability within schools on the basis of government guidelines, and ten studies explored food purchasing and consumption by students influenced by changes to the school food environment. Results showed low compliance with government healthy food guidelines for schools, and significant socioeconomic disparities. Western Australia's clear targets as well as the mandatory monitoring systems in place stand out as being a significant enabler of greater compliance with government food policies. Interventions aimed at improving healthy food availability and promoting healthy options in the canteen may positively influence student purchasing and consumption habits. Strategies such as feedback models and incentivisation hold promise for promoting healthier school environments and influencing children's food choices.

Introduction

Globally, one in six children are classified as overweight or obese⁽¹⁾ with higher rates reported in New Zealand and Australia where one in three children in New Zealand, and one in four children in Australia are classified as overweight or obese^(1–3). Habitual dietary intakes and nutrition behaviours developed during childhood and adolescence pave the way for similar behaviours to manifest in adulthood^(4,5). However early modification in eating behaviours might decrease the risk of obesity and diet-related disease. Evidence suggests that altering the food environment offers opportunities for children to adopt healthier behaviours and seems to be an effective strategy to prevent childhood obesity^(6,7). Given that children spend much of their weekday waking hours at school, alterations to the school food environment may provide an opportunity to improve dietary behaviours⁽⁸⁾. School food provision in New Zealand and Australia is similar, where children may purchase food and beverages during break times (morning tea and lunch) from the school canteen which may be catered for internally by the school or by external food suppliers such as local bakeries and convenience stores. The majority of schools in New Zealand and Australia are publicly funded, meaning that government school food environment policies have significant potential to improve targeted dietary behaviours⁽⁹⁾. However, in New Zealand and Australia, evidence suggests that schools do not encourage healthy food and drink consumption⁽⁸⁾, with poor implementation of food policies^(10,11), unhealthy food and drink availability using canteen profit models^(8,12,13) and a time-scarce curriculum with little room for nutrition education^(14,15). It is therefore unsurprising that children consume more unhealthy foods on school days compared with non-school days⁽¹⁶⁾.

Within New Zealand, previous legislation sought to improve the food environment in schools. In 2008, all government-funded schools were required to promote healthy food choices and have *only* healthy options available where food and beverages were sold on school premises^(17,18). Despite a 66% uptake of this legislation⁽¹⁸⁾, following a change in government in 2009 the requirement for *only* healthy food options was removed, placing the onus on the school boards of trustees to mandate healthy food and drinks within schools^(17,18). More recently,

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3.3. Supplementary Files

Supplementary File 3A: Critical Appraisals assessing study quality and risk of bias

JBI – Critical Appraisal Tool for Cross Sectional Analyses

	Inclusion criteria	Subjects & setting	Exposure Measurement	Measurement criteria	Confounding factors identified	Confounding strategies	Outcome Measurement	Statistical Analysis
Clinton McHarg 2018	Y	Y	Y	Y	Y	Y	Y	Y
Carter 1999	Y	Y	Y	Y	U	N	Y	Y
Haynes 2021	Y	Y	Y	Y	Y	Y	Y	Y
Myers 2019	Y	Y	Y	Y	U	N	Y	Y
Reilly 2018	Y	Y	Y	Y	Y	Y	Y	Y
Reilly 2021	Y	Y	Y	Y	U	N	Y	Y
Pillay 2023	Y	Y	Y	Y	U	N	Y	Y
Silva-Sangiorski 2011	Y	Y	Y	Y	Y	Y	Y	Y
Woods 2014	Y	Y	Y	Y	U	N	Y	Y
Yoong 2015	Y	Y	Y	Y	Y	Y	Y	Y
Hill 2023	Y	Y	Y	Y	Y	Y	Y	Y
Leonard 2021	Y	Y	Y	Y	Y	Y	Y	Y
Smith 2019	Y	Y	Y	Y	U	N	Y	Y

Abbreviations: Y, yes; N, no; U, unclear.

JBI – Critical Appraisal Tool for RCTs

	Randomisation	Allocation Concealment	Baseline Comparability	Participant Blinding	Treatment Blinding	Identical Treatment	Assessment Blinding	Outcome Measure	Measure reliability	Follow-up	Controlled Groups	Statistical Analysis	Trial Design
Nathan 2016	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Wolfenden 2017	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Yoong 2016	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Delaney 2023	Y	Y	Y	U	N	Y	Y	Y	Y	Y	Y	Y	Y
Delaney 2022	Y	Y	Y	U	N	Y	Y	Y	Y	Y	Y	Y	Y
Sutherland 2022	Y	Y	Y	N	N	Y	N	Y	Y	U	Y	Y	Y
Wyse 2021	Y	Y	Y	N	N	Y	U	Y	Y	Y	Y	Y	Y
Delaney 2017	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y

Abbreviations: Y, yes; N, no; U, unclear.

JBI – Critical Appraisal Tool for Cohort Studies

	Group Similarity	Exposure Measurement	Validity and reliability of exposure	Confounding factors	Confounding strategies	Baseline	Outcome measurement	Follow-up time	Follow-up complete	Follow-up strategies	Statistical Analysis
Hill 2015	Y	U	Y	Y	N	U	Y	Y	N	U	Y

Abbreviations: Y, yes; N, no; U, unclear.

Appendix 4: Chapter 5 Additional Files

4.1. Statement of Contribution

 MASSEY UNIVERSITY TE KUNENGA KI PŪREHUROA UNIVERSITY OF NEW ZEALAND		GRADUATE RESEARCH SCHOOL	
STATEMENT OF CONTRIBUTION DOCTORATE WITH PUBLICATIONS/MANUSCRIPTS			
We, the student and the student's main supervisor, certify that all co-authors have consented to their work being included in the thesis and they have accepted the student's contribution as indicated below in the Statement of Originality.			
Student name:	Danika Pillay		
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In which chapter is the manuscript/published work?	Chapter 5		
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☒ The manuscript/published work is published or in press Please provide the full reference of the research output: Pillay, D, Piddington, M, Ali, A, Wham, C. (2023). Food menus within New Zealand primary school canteens: Do they meet the guidance? Health Promotion Journal of Australia. 35(3), 628-637. https://doi.org/10.1002/hpja.793			
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RESEARCH ARTICLE

Health Promotion
Journal of Australia



WILEY

Food menus within New Zealand primary school canteens: Do they meet the guidance?

Danika Pillay | Marsha Piddington | Ajmol Ali | Carol Wham

School of Sport, Exercise and Nutrition,
Massey University, Auckland, New Zealand

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Funding information

Massey University; Sport New Zealand;
Ministry of Health; Ministry of Education

Handling editor: Annabelle Wilson

Abstract

Issue Addressed: Unhealthy food and drinks are widely available in New Zealand school canteens. The aim of this study was to assess primary school canteen food menus against the newly implemented Ministry of Health 'Food and Drink Guidance for Schools'.

Methods: A convenience sample of 133 primary school canteen menus was collected in 2020 as part of the baseline evaluation of the Healthy Active Learning initiative across New Zealand. A menu analysis toolkit was developed to assess menus in accordance with the Ministry of Health's 'Food and Drink Guidance for Schools' which classifies food items into three food categories: 'green', 'amber' and 'red'.

Results: Most menu items belonged to the less healthy amber (41.0%) and red (40%) food categories. Low decile schools had a lower percentage of green food items (8.6%) and a higher percentage of red food items (48.3%) compared to high decile schools. Sandwiches, filled rolls and wraps were the most commonly available items, followed by baked foods and foods with pastry. Over half of the in-house canteen menu items were classified as 'red' foods (55.3%).

Conclusions: Most school canteens were not meeting the guidelines for healthy food and drink provision outlined by the Ministry of Health. Improving the food environment for children in socio-economically deprived areas needs to be prioritised to reduce inequities.

So What? This study highlights the unhealthy food environments in New Zealand schools and emphasises the need for more robust national policies and mandated school guidance.

KEYWORDS

childhood nutrition, food policy, healthy active learning, menu audit, policy evaluation, school food environment, traffic-light guidance

1 | INTRODUCTION

Childhood obesity and overweight rates in New Zealand are considerably higher than those reported globally,¹ with one in three children aged between 2 and 14 years identified as overweight or obese.² Unhealthy diets, physical inactivity and childhood obesity have strong links with the development of non-communicable diseases,^{3,4} can

negatively influence educational outcomes^{5,6} and have an adverse impact on the psychological well-being of children.^{4,7}

Children's dietary knowledge and food preferences are influenced by various factors, both modifiable and non-modifiable, including the food environment.⁸⁻¹⁰ Schools are an excellent setting to influence children's dietary behaviours since they have the potential to reach almost all children during the first two decades of their lives.¹¹ To

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Appendix 5: Chapter 6 Additional Files

5.1. Statement of Contribution

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STATEMENT OF CONTRIBUTION

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Name and title of main supervisor:	Professor Ajmol Ali		
In which chapter is the manuscript/published work?	Chapter 6		
Describe the contribution that the student and members of the supervisory team have made to the manuscript/published work: ¹			
Danika designed and conceptualised the study, completed the data analysis, and wrote the paper. Supervisors Prof. Ajmol Ali and Prof. Carol Wham assisted in the conceptualisation of the study and edited and reviewed the final version.			
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☒	The manuscript/published work is published or in press Please provide the full reference of the research output: Pillay, D., Ali, A., & Wham, C. (2026). Three Years Later: Healthiness of Food in New Zealand Primary School Canteens Following Implementation of the Healthy Food and Drink Guidance. Health Promotion Journal of Australia: 37(1), e70135. https://doi.org/10.1002/hpja.70135		
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5.2. Journal Publication

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RESEARCH ARTICLE

Three Years Later: Healthiness of Food in New Zealand Primary School Canteens Following Implementation of the Healthy Food and Drink Guidance

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ABSTRACT

Issue Addressed: One-third of children in New Zealand (NZ) are overweight or obese, with suboptimal dietary patterns. The NZ government implemented the Healthy Active Learning (HAL) initiative and the 'Healthy Food and Drink Guidance for Schools' (2020) to improve school food environments. This study aimed to evaluate the impact of these guidelines over 3 years.

Methods: A convenience sample of 89 primary schools (4.6% of NZ primary schools) provided menus at baseline (2020/2021) and follow-up (2023/2024). Food items were categorised according to the guidance using a traffic-light criteria (green, amber, red).

Results: 'Green' menu items increased from 15.5% to 21.2%. 'Amber' items decreased from 44.4% to 33.8% ($p = 0.005$). 'Red' items showed minimal change (35.4% to 37.5%). There were reductions in the presence of sugar-sweetened beverages (40% to 31%) and ultra-processed savoury snacks (42% to 33%). Schools in affluent areas reduced 'amber' foods, while schools in high deprivation areas saw minimal change in 'green' foods (8.6% to 7.2%) and 'red' foods (32.4% to 29%).

Conclusions: The guidance implementation led to modest improvements in the healthiness of school menus, particularly reducing 'amber' foods and ultra-processed snacks. The limited increase in healthy 'green' foods and the persistent presence of unhealthy 'red' foods highlight the need for further intervention.

So What? This study emphasises the importance of sustained efforts to improve the nutritional quality of school food, particularly in communities facing socioeconomic challenges. National consistency, monitoring, and feedback are needed to support policy implementation and ensure children have equitable access to healthy food at school.

1 | Introduction

One-third of children from birth to 14 years of age in New Zealand (NZ) are considered to be overweight or obese [1]. Childhood weight status is likely to carry into adulthood [2], alongside learned nutrition behaviours [3]. The percentage of children classified as overweight or obese has remained relatively unchanged since 2013 [1]. This is not surprising, given that children's dietary patterns in NZ are suboptimal with less than half of children achieving the recommended servings of fruits and vegetables per day, and frequent consumption of confectionery

and processed meat products [4]. The NZ government has taken initial steps toward improving nutrition and physical activity in schools, primarily through educational initiatives, voluntary guidelines, and programme-based approaches, with a stronger emphasis on physical activity promotion than on comprehensive nutrition policy [1, 5–7].

In NZ, school attendance is compulsory for those aged between six and 16 years [8], enabling schools to reach almost all children and adolescents in the first two decades of their lives. There is a significant association between healthy

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5.3. Supplementary Files

Supplementary Table 5A: Percentage of 'green', 'amber', and 'red' food items in the sample of New Zealand primary schools (n=89) at baseline and follow-up.

	Baseline (%)	Follow-Up (%)
Green foods	15.5 [7.0, 24.7]	21.2 [8.7, 30.2]
Amber foods	44.4 [27.4, 56.9]*	33.8 [18.0, 55.4]*
Red foods	35.4 [21.4, 47.5]	37.5 [25.1, 49.3]

Percentages reported as median [IQR].

**statistically significant differences ($p < 0.05$)*

Supplementary Table 5B: Differences in the percentage of ‘green’, ‘amber’, and ‘red’ foods on New Zealand primary school menus (n=89) based on demographic characteristics at baseline (2020/2021) and follow-up (2023/2024).

	Baseline (2020/2021) [^]			Follow-up (2023/2024) [^]			Baseline vs Follow-Up		
	Green	Amber	Red	Green	Amber	Red	p-value Green	p-value Amber	p-value Red
School type									
Contributing (1-6)	16.2 [7.0, 24.4]	44.0 [25.0, 56.5]	35.4 [23.9, 47.5]	21.3 [8.9, 28.8]	30.8 [21.6, 52.5]	42.1 [28.9, 50.0]	0.273	0.026*	0.040*
Full (1-8)	14.9 [8.0, 25.9]	44.8 [27.8, 60.0]	33.7 [19.3, 51.9]	20.9 [5.9, 31.6]	37.5 [14.4, 57.1]	31.0 [22.9, 46.4]	0.258	0.077	0.844
Deciles									
High deprivation (1-3)	15.5 [4.3, 18.5]	51.4 [40.8, 63.8]	40 [28.5, 40.9]	15.8 [3.8, 32.6]	47.7 [84.4, 35.5]	31.4 [36.7, 11.9]	0.225	0.893	0.225
Medium deprivation (4-7)	12.5 [4.3, 26]	43.0 [21.5, 55.5]	32.6 [21.3, 68.7]	14.0 [4.2, 29.2]	30.8 [57.9, 14.4]	36.8 [55.2, 18.3]	0.951	0.620	0.694
Low deprivation (8-10)	17.1 [10.6, 25.8]	45.2 [28.2, 60.0]	35.8 [21.1, 46.9]	22.1 [12.9, 30.4]	33.3 [19.4, 45.2]	39.4 [48.8, 25.0]	0.108	0.002*	0.016*
School size									
Small	11.6 [0.0, 14.9]*	38.5 [18.2, 52.1]*	52.4 [30.7, 81.8]*	16.7 [0.0, 40.9]	13.4 [6.4, 38.9]*	44.4 [34.4, 88.1]*	0.177	0.088	0.535
Medium	15.5 [5.0, 25.8]	46.8 [38.7, 63.2]*	28.8 [19.0, 40.5]*	20.7 [8.5, 30.8]	41.2 [25.0, 62.2]*	31.4 [16.7, 47.7]*	0.051	0.014*	0.084
Large	20.4 [12.7, 24.5]*	40.5 [24.6, 51.4]	36.7 [27.5, 47.7]	21.9 [13.8, 28.4]	30.9 [22.9, 50.1]	38.9 [22.9, 50.1]	0.655	0.638	0.505
Area									
Rural	11.6 [0.0, 19.3]	34.9 [20.3, 60.0]	43.1 [26.6, 67.7]	14.4 [0.0, 42.6]	27.5 [9.6, 59.6]	38.2 [24.4, 76.8]	0.382	0.244	0.910
Urban	16.7 [8.7, 25.4]	45.3 [29.9, 56.7]	33.3 [20.6, 46.4]	22.0 [10.4, 29.9]	34.5 [21.8, 55.4]	37.5 [21.9, 49.1]	0.153	0.013*	0.057
Region									
Northland	6.3 [0.0, 18.6]	45.1 [24.9, 50.6]	40.5 [35.0, 74.9]	22.0 [11.9, 34.4]	25.7 [11.9, 34.4]	44.4 [36.8, 67.0]	0.080	0.043*	0.686
Auckland	22.6 [15.2, 27.4]*	36.1 [24.3, 46.7]*	38.1 [30.7, 47.5]	24.4 [16.9, 31.1]*	30.1 [18.7, 35.4]	46.5 [31.7, 51.9]*	0.773	0.056	0.033*
Bay of Plenty	11.7 [3.4, 13.5]*	58.3 [38.1, 71.4]	26.9 [19.4, 50.8]	7.1 [0.7, 12.7]*	63.7 [20.7, 71.8]	26.6 [16.4, 77.4]	0.157	0.124	0.691
Wellington	20.2 [7.0, 28.1]	51.0 [45.3, 67.3]*	23.5 [14.7, 35.6]*	25.6 [15.9, 31.5]*	44.8 [35.2, 59.6]	25.9 [15.1, 36.2]*	0.057	0.204	0.889
South Island	14.2 [5.9, 20.0]	34.3 [19.1, 47.6]*	46.6 [29.2, 69.1]*	16.3 [2.2, 41.1]	25.0 [10.6, 42.2]	42.9 [33.9, 75.8]*	0.328	0.140	0.507
Deprivation									
Low deprived (1-3)	14.0 [10.5, 24.4]	46.2 [28.2, 60.0]	33.3 [19.1, 47.5]	22.0 [11.8, 30.6]	30.8 [21.6, 55.0]	37.4 [20.0, 49.3]	0.073	0.011*	0.359
Medium deprivation (4-7)	19.6 [7.0, 27.6]	40.0 [24.1, 47.5]	36.9 [23.9, 48.3]	25.5 [14.0, 30.4]*	31.0 [17.1, 45.2]	39.5 [30.2, 49.2]	0.577	0.085	0.086
High deprivation (8-10)	8.6 [2.2, 16.2]	56.5 [43.0, 67.6]	32.4 [16.9, 40.0]	7.2 [1.6, 15.8]*	57.8 [37.2, 74.6]	29.0 [16.7, 52.4]	0.953	0.799	0.799
Equity index									
Few barriers	19.4 [10.0, 25.8]	45.4 [30.0, 56.9]	32.9 [19.4, 47.1]	22.4 [14.3, 30.3]	35.2 [22.4, 52.5]	37.9 [23.9, 48.6]	0.113	0.008*	0.055
Moderate barriers	12.5 [5.6, 16.7]	40.6 [17.6, 54.5]	36.5 [25.6, 66.6]	12.9 [0.0, 30.0]	25.0 [12.0, 55.8]	37.6 [23.9, 48.6]	0.627	0.205	0.527
More barriers [#]	10.1 [0.0, 20.2]	49.4 [38.7]	40.6 [40.0]	10.9 [5.90]	70.9 [47.7]	18.4 [0.0]	-	-	-

[^]reported as median [IQR]

*statistically significant p<0.05

[#] due to a small sample size, statistical analyses could not be completed with EQI category ‘more barriers’ (n=2). Analyses compared those with ‘few barriers’ and ‘moderate barriers’ within groups and from baseline to follow-up.

Appendix 6: Chapter 7 Additional Files

6.1. Statement of Contribution



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STATEMENT OF CONTRIBUTION

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We, the student and the student's main supervisor, certify that all co-authors have consented to their work being included in the thesis and they have accepted the student's contribution as indicated below in the Statement of Originality.			
Student name:	Danika Pillay		
Name and title of main supervisor:	Professor Ajmol Ali		
In which chapter is the manuscript/published work?	Chapter 7		
Describe the contribution that the student and members of the supervisory team have made to the manuscript/published work: ¹ Danika designed and conceptualised the study, completed the data analysis, and wrote the paper. Supervisors Prof. Ajmol Ali and Prof. Carol Wham assisted in the conceptualisation of the study and edited and reviewed the final version.			
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Policy v. practice: school food practices do not reflect healthy food guidance in New Zealand primary schools

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Abstract

Objective: To examine how school food policies and perceived barriers influence food provision in New Zealand primary school canteens, using the 'Healthy Food and Drink Guidance for Schools'. **Design:** Cross-sectional analyses of school food menus and school food policy and practices surveys completed by school leaders/principals. **Setting:** New Zealand primary schools. **Participants:** 239 primary schools completed the school food policies and practices survey, and eighty schools provided canteen menus. **Results:** Most schools reported having a healthy food and drink policy in their school (76.2 %) and promoted healthy eating during school hours (87.4 %). Two-thirds (69.5 %) identified barriers to healthy food and drink provision, most commonly the convenience of ready-made foods (39.3 %), and resistance from parents (34.3 %). The number of reported barriers was not a significant predictor for the presence of a school food policy (OR=1.034, $P=0.841$). School menus ($n=80$) consisted of 16.4 % 'green' items, 34.7 % 'amber' items and 36.8 % 'red' items. There was no relationship between the percentage of 'green', 'amber' and 'red' items and the presence of a school food policy or reported barriers. More than a third (38.9 %) of menus from schools that reported they had a 'Plain Milk and Water' only policy still contained sugar-sweetened beverages. **Conclusions:** Although most New Zealand primary schools had healthy food policies, this was not consistently reflected in healthy food items on canteen menus. Further research is needed to understand how systemic barriers, such as cost, convenience and parental influence, affect policy implementation and school food provision.

Unhealthy dietary behaviours are a contributing factor to childhood overweight and obesity, and poorer educational outcomes, health status and mental health among children and adolescents⁽¹⁾. Dietary behaviours that develop during childhood and adolescence often continue into adulthood and may have significant impacts on the economic welfare and capacity of the healthcare system^(2,3). Obesogenic food environments have been identified as a major contributor to unhealthy dietary patterns^(4,5). The school food environment has been recognised as a significant setting for influencing dietary behaviours and has the potential to reach the majority of children and adolescents during key periods of growth and development⁽⁶⁾. The 'Nutrition-Friendly Schools Initiative Framework' developed by the WHO recognises that having comprehensive school nutrition policies incorporating multiple components of diet, physical activity, education and environmental changes can positively influence weight, diet and health behaviours in schoolchildren⁽¹⁾.

Children attend school in New Zealand (NZ) for 6–7 h, 5 days a week from the age of 5 years⁽⁷⁾. Most children consume one-third of their daily food intake during school hours, and it is estimated that the average child will consume approximately 2400 lunches at school through their schooling years^(8,9). The NZ school food system is complex and encompasses packed lunches, school canteens and tuckshops, commercial catering, charitable donations, and for some, the Healthy School Lunches programme⁽¹⁰⁾. While the Healthy School Lunches programme (Ka Ora Ka Ako) in NZ was designed to provide free lunches to 25 % of students most in need based on the schools' calculated equity index (EQI) score⁽¹¹⁾, school canteens operate as facilities on site that students can purchase lunch or snacks from which also serves as source of income for the school⁽¹²⁾. Buying lunch from the school canteen has been associated with a higher intake of discretionary food, sugary drinks, and lower fruit and vegetable intake compared with packed lunches and food consumed at home^(13,14). The NZ government recently launched the Healthy Active Learning (HAL) initiative as part of its Child and Youth Well-Being Strategy in 2020⁽¹⁵⁾. In conjunction, the Ministry of Health released the voluntary 'Healthy Food and Drink Guidance for Schools' in 2020 to help schools create policies promoting healthy food and drinks within schools, replacing the 'Food and Beverage Classification System' previously used⁽¹⁶⁾. The guidance utilises a traffic-light system which classifies foods into 'green' (nutrient-rich), 'amber' (some nutritional value) and 'red' foods (low nutritional value, higher in

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6.3. Supplementary Files

Supplementary Table 6A: Presence of a Healthy Food and Drink Policy based on school characteristics.

		Total sample (n=239) n (%)	Schools with a Food and Drink Policy n (% group)
Years [¥]	Contributing (1-6)	117 (49)	89 (76.1)
	Full primary (1-8)	122 (51)	93 (76.2)
Region [#]	Upper North Island	79 (33.1)	56 (70.9)
	Central North Island	48 (20.1)	37 (77.1)
	Lower North Island	45 (18.8)	36 (80.0)
	Upper South Island	37 (15.5)	33 (89.2)
	Lower South Island	30 (12.6)	20 (66.7)
Decile	Low deprivation (7-10)	48 (20.1)	32 (66.7)
	Medium deprivation (4-6)	86 (36.0)	68 (79.1)
	High deprivation (1-3)	105 (43.9)	82 (78.1)
Equity Index [^]	Few barriers	50 (20.9)	36 (72.0)
	Moderate barriers	108 (45.2)	77 (71.3)
	More barriers	81 (33.9)	69 (85.2)
Deprivation	Low (1-3)	35 (14.6)	27 (77.1)
	Medium (4-6)	101 (42.3)	76 (75.2)
	High (7-10)	103 (43.1)	79 (76.7)
School Size	Small	124 (51.9)	93 (75.0)
	Medium	71 (29.7)	55 (77.5)
	Large	44 (18.4)	34 (77.3)
Area	Urban	162 (67.8)	126 (77.8)
	Rural	77 (32.2)	56 (72.7)

¥ Contributing primary schools are defined as those teaching years 1-6 (ages 5-11). Full primary schools teach years 1-8 (ages 5-13).

Regions have been condensed to accommodate for smaller sample sizes in some regions. Upper North Island combined Auckland and Northland; Central North Island includes Hawkes Bay, Waikato, Taranaki, and Bay of Plenty; Lower North Island includes Manawatu-Whanganui and Wellington; Upper South Island includes Marlborough, Canterbury, and West Coast; and Lower South Island includes Otago and Southland.

[^]Equity index reported per the Ministry of Education socioeconomic reporting bands for 2024: few barriers (344-428), moderate barriers (429-493), more barriers (494-569).

*p-value <0.05 considered significant between two groups, Bonferroni correction applied for three or more groups.

Supplementary Table 6B: Healthiness of school food menus based on the presence of a Healthy Food and Drink Policy or perceived barriers.

		Green (%)	Amber (%)	Red (%)
Total sample (n=80)		16.4 [2.8, 28.8]	34.7 [8.4, 49.1]	36.8 [23.7, 59.6]
Healthy Food and Drink policy	Yes	16.7 [2.8, 30.9]	34.7 [8.4, 49.1]	36.8 [23.5, 57.7]
	No [#]	17.7 [3.3, 28.8]	37.4 [7.9, 65.9]	33.8 [19.9, 61.5]
Barriers [^]	Yes	9.7 [2.8, 28.8]	35.1 [9.4, 59.3]	40.4 [23.5, 67.9]
	No barriers	25.0 [0.0, 32.3]	34.4 [8.1, 46.8]	37.5 [26.7, 43.1]

Values reported as median [25th, 75th percentile]

including those who would like to have a food policy but currently do not.

[^] A total of 51/80 schools listed at least one barrier to providing healthy food and drinks in schools and are represented in the 'yes' category.

* p value <0.05 considered significant.

Appendix 7: Chapter 8 Additional Files

7.1. Statement of Contribution



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STATEMENT OF CONTRIBUTION DOCTORATE WITH PUBLICATIONS/MANUSCRIPTS

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Student name:	Danika Pillay		
Name and title of main supervisor:	Professor Ajmol Ali		
In which chapter is the manuscript/published work?	Chapter 8		
Describe the contribution that the student and members of the supervisory team have made to the manuscript/published work: ¹ Danika designed and conceptualised the study, completed the data analysis, and wrote the paper. Supervisors Prof. Ajmol Ali and Prof. Carol Wham assisted in the conceptualisation of the study and edited and reviewed the final version.			
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Appendix 8: Menu Analysis Toolkit

Packaged food				
Food Item	Brand	Rating	Justification	Guidelines
Plain Rice Cracker	No Brand Countdown Fantastic Peckish Thins	Red Red Red Red	Average HSR of food group	"Breads and Crackers" Amber: Refined crackers/crispbread w/ HSR ≥ 3.5
Flavoured Rice Cracker	No Brand Ceres Organic Peckish Thins	Red Amber Red	Average HSR of food group	"Breads and Crackers" Amber: Refined crackers/crispbread w/ HSR ≥ 3.5
Brown Rice Cracker	No Brand Ceres Organic Countdown	Green Green Green	Average HSR of food group	"Breads and Crackers" Green: Wholegrain/wholemeal w/ HSR ≥ 3.5
Whole Grain Cracker	No Brand Arnotts: Salada Arnotts: Vita Weat 9 Grain Arnotts: Vita Weat Original Arnotts: Vita Weat Sesame Huntly & Palmers: 8 Grains Huntly & Palmers: Sesameal Huntly & Palmers: Sesameal 5 Grain Huntly & Palmers: Sprouted Rye	Green Red Green Green Green Green Red Red Green	Average HSR of food group	"Breads and Crackers" Green: Wholegrain/wholemeal w/ HSR ≥ 3.5
Thin & light crackers	No Brand Arnotts: Cruskits Corn Arnotts: Cruskits Original Ceres Organics: Brown Rice Cakes Original Huntly & Palmers: Litebread Mixed Grain Huntly & Palmers: Litebread Original Real Foods: Corn Thins Sunrice: Quinoa Thin Rice Cake	Green Red Green Green Red Amber Green Green	Average HSR of food group	"Breads and Crackers" Amber: Refined crackers/crispbread w/ HSR ≥ 3.5
Other Crackers	No Brand Countdown: Garlic Crackers Countdown: Plain Water Griffins: Meal Mates Original Griffins: Snax Original Huntly & Palmers: Cream Huntly & Palmers: Somerset Nairns: Scottish Oat Cakes Ritz Rutherford & Meyer: Rice Wafer Cracker	Red Red Red Red Red Red Red Red Red	Average HSR of food group	"Breads and Crackers" Amber: Refined crackers/crispbread w/ HSR ≥ 3.5
Croutons/Breadsticks	No Brand Grissini: Bread Sticks Hansells: Bread Croutons Plain Hansells: Soup & Salad Crouton Herb	Red Red Red Red	Average HSR of food group	"Bread and Crackers" Amber: Refined crackers/crispbread w/ HSR ≥ 3.5
Bread Products	No Brand Golden Bakery: Crumpets Quality bakers: Muffin Splits Tip Top: Oatlicious United: Bao Steamed Buns	Amber Amber Amber Amber Amber	Average HSR of food group	"Breads and Crackers" Green: Other bread products w/ <5 g fibre and ≥ 450 mg sodium/100g
Fruit Bread	No Brand Vogels Tip Top Borgen Quality bakers	Amber Amber Amber Amber Amber	Average HSR of food group	"Breads and Crackers" Green: Other bread products w/ <5 g fibre and ≥ 450 mg sodium/100g
Fruit Products	Fruit Hitz Countdown Peach cups (in Juice) Fruit Crush Ups Pure NZ Apple Chps Annies Fruit Bars Watties Fruit Squirtz	Amber Amber Amber Amber Amber Amber	Average HSR of food group	"Fruit" Amber: Fruit products with an HSR of ≥ 3.5
Pastry	No Brand Edmonds: Flaky Puff Pastry Edmonds: Savory Short Pastry Timos: Filo Pastry	Amber Amber Amber Green	Average HSR of food group	"Breads and Crackers" Green: Other bread products w/ <5 g fibre and ≥ 450 mg sodium/100g

Packaged iceblocks / popsicle	No Brand	Red	Average HSR of food group	"Packaged Snack Foods" Amber: HSR ≥ 3.5 AND kJ ≤ 800
	Juicies: (assorted flavour)	Amber		
	Kiwi Crushies: Wildberry	Amber		
	Twisted: Pink lemon twist plant based iceblock	Amber		
	Streets: Calipo	Red		
	Streets: Cyclone	Red		
	Tiptop: Fruju pineapple crush iceblock	Red		
	Tiptop: Lemonade iceblock	Red		
Packaged Snack Food	No Brand	Red	Average HSR of food group	"Packaged Snack Foods" Amber: HSR ≥ 3.5 AND kJ ≤ 800
	Healtheries: Potato Stix Roast	Red		
	Healtheries: Rice Wheels Sour Cream & Chives	Red		
	Healtheries: Oven baked Twirls	Red		
	Harvest Snaps: Pea Snacks	Red		
	Original Salted	Red		
	Pop'n'Good: Light and buttery popcorn 25g	Red		
	NZ Kettle Korn: Sweet and Salted Popcorn	Red		
	Sweet as Popcorn: Sea Salt	Amber		
	NZ Kettle Korn: Sea Salt	Amber		
	Popcorn	Amber		
	Countdown: Salted pretzel twists	Red		
	Le Snak: Cracks N Dip Cheese	Red		
	Frooze balls: Snack Balls	Red		
	Fugetastic	Red		
	Tom & Luke: Snackaballs	Red		
	Peanut Butter	Red		
	Countdown: Fruit salad in juice cup	Amber		
	Countdown: Peaches in juice cup	Amber		
	Countdown: Jelly fruit cup	Red		
	Pams: Jelly fruit cup	Red		
	Mexicano Corn Chips: Unflavoured	Red		
	Mexicano Corn Chips: Flavoured	Red		
	Go nuts: Corn chips Tasy Cheese	Amber		
	Go nuts: Corn chips all flavour 150g packet	Red		
	Doritos: Cheese supreme 45g	Red		
	Countdown: Cassava vegetable crisps original	Red		
	Amott's: Shapes 70g (assorted flavour)	Red		
	Sunny Hill: Kumara chips (original) 40g	Red		
	Pringles, single serve, 53g	Red		
	Pita Crisps	Red		
	Mother Earth Fruit Sticks	Amber		
	Fresher: Chip packet (assorted flavour)	Red		
Seaweed	Ceres	Green		
	Nishin: Sweet seaweed	Red		
Muesli Bars	No Brand	Red	Average HSR of food group	"Baked Items" Amber: Muesli bars w/ a HSR ≥ 3.5
	Countdown: Yoghurt Muesli Bars	Amber		
	Countdown: Chewy muesli	Amber		
	Countdown: Nut bar	Red		
	Countdown: Oven baked fruit filled bars	Red		
	Countdown: Oaty Slice	Red		
	Chocolate Chip	Red		
	Fibre one: Muesli bar	Red		
	Flemings: Chewy muesli	Red		
	Kellogs: Nutrigrain cereal bar	Red		
	Kellogs: LCM cereal bar	Red		
	Mother Earth: Wellbeing sustain muesli bar	Amber		
	Mother Earth: Baked Oaty Slice	Red		
	Mother Earth: Fruit sticks/vege fruit sticks	Amber		
	Nature Valley: Crunchy oats and honey	Red		
	Nestle: Cereal bar	Red		
	Nice & Natural: Protein nut bar	Red		
	Tasti: Snak logs	Red		
	Tasti: Milkies muffin bar	Amber		
	Tasti: Protein bar muesli bar	Red		
	Tasti: Mega nuts	Red		
	Tasti: Frutsies	Red		
	Tasti: Made Simple muesli bar	Amber		

Muesli	No Brand Ceres Organics: Blueberry/LSA bircher muesli Ceres Organics: Cacao Almond Macadamia Bircher Ceres Organics: Original Bircher Chantal organics: Swiss Bircher muesli Countdown: Natural Muesli Countdown: Toasted Muesli Macro organic: Natural Muesli Moore Wilson's: Highland Muesli toasted Sanitarium: Cluster crisp Sanitarium: Light n tasty	Amber Green Amber Green Amber Amber Amber Green Amber Amber Amber	Average HSR of food group	"Breakfast Cereals" Green: Wholegrain cereal and porridge w/ HSR ≥ 3.5 and $\leq 15g$ sugar/100g Amber: HSR ≥ 3.5
Corn Flakes	No Brand Countdown: Cornflakes Hubbards: Cornflakes Kellogs: Cornflakes Pams: Cornflakes Sippys: Cornflakes	Red Amber Red Red Red Amber	Average HSR of food group	"Breakfast Cereals" Amber: HSR ≥ 3.5 Red: Cereals w/ HSR < 3.5
Rice Pops	No Brand Countdown: Rice pops Hubbards: Rice pops Sanitarium: Ricles	Red Red Red Red	Average HSR of food group	"Breakfast Cereals" Red: Cereals w/ HSR < 3.5
Cereals	No Brand Kellogs: Coco pops Kellogs: Fruit Loops Kellogs: Nutri Grain Kellogs: Sultana Bran Nestle: Milo cereal	Red Red Red Red Red Red	Average HSR of food group	"Breakfast Cereals" Red: Cereals w/ HSR < 3.5
Fries, Wedges, Hashbrowns	No Brand Birds eye: Golden crunch crinkle fries Birds eye: Seasoned fries Mccain: Beer batter Fries Steak Cut Mccain: Beer batter wedges Mccain: Pub style wedges Mccain: Shoestring fries Super oven golden chips Watties: Original wedges Watties: Tempura wedges McCain Hashbrowns Golden McCain Quick Cook Hashbrowns Watties Classic Hashbrowns	Amber Amber Amber Amber Amber Amber Amber Amber Amber Amber Amber Amber	Average HSR of food group	"Vegetables" Amber: Vegetable products w/ HSR ≥ 3.5
Creamed Corn	No Brand Countdown: Creamed corn Edgell: Creamed corn Watties: Creamed corn	Amber Amber Amber Amber	Average HSR of food group	"Vegetables" Amber: Vegetable products w/ HSR ≥ 3.5
Pickled Vegetables	No Brand Countdown: Sundried tomatos Countdown: Gherkin Delmaine: Olives pitted green	Red Red Red Red	Average HSR of food group	"Vegetables" Amber: Vegetable products w/ HSR ≥ 3.5
Yoghurt Individual Pottles/Pouches	No Brand Anchor: Calci yum yoghurt range Anchor: Uno yoghurt range EasiYo: Natural Yoghurt Fresh n Fruity: Flavoured yoghurt range Meadow Fresh: Creamy berries yoghurt Moogurt: Suckies yoghurt kids range The Collective: 'Suckies' yoghurt range Yoplait: Viguer classic chocolate yoghurt	Green Green Green Amber Green Green Green Green Green Green Red	Average HSR of food group	"Milk Products" Green: Low/Reduced Fat w/ HSR ≥ 3.5 Amber: Full fat w/ HSR ≥ 3.5 Red: HSR < 3.5
Youghut Tubs	No Brand Yoplait: real fruit range Yoplait: lemon Yoplait: natural sweetened	Green Amber Green Green	Average HSR of food group	"Milk Products" Green: Low/Reduced Fat w/ HSR ≥ 3.5 Amber: Full fat w/ HSR ≥ 3.5 Red: HSR < 3.5

Cheese	No Brand Countdown: Colby Countdown: Mild Mainland: Crumbly Feta Mainland: Tasty Mainland: Parmasen Mainland: Mozzarella Smart Choice: Cheese cafe bakery blend grated (Bidfood) Ornelle: Camembert Thomas dux: Brie Galaxy: Creamy feta Southern Range: Cheese pizza blend grated (Bidfood)	Amber Amber Amber Amber Red Green Green Green Red Red Red amber Green Red Red amber	Assumption '31' Type of cheese blend	"Milk Products" Green: Low/Reduced Fat w/ HSR ≥ 3.5 Amber: Full fat w/ HSR ≥ 3.5 Red: HSR < 3.5
Custards	No Brand Meadow Fresh: Custard vanilla Anchor: Custard Vanilla Thick & Creamy Alpro: Soya Custard Vanilla Dairy Free	Amber Amber Amber Amber	Average HSR of food group	"Milk Products" Green: Low/Reduced Fat w/ HSR ≥ 3.5 Amber: Full fat w/ HSR ≥ 3.5 Red: HSR < 3.5
Iced Milk Product	No Brand Moosie Twisted: Licks iceblock (Mango) Twisted: Frozen yoghurt minis (chocolate + vanilla)	Red Red Red Amber	Average HSR of food group	"Milk Products" Green: Low/Reduced Fat w/ HSR ≥ 3.5 Amber: Full fat w/ HSR ≥ 3.5 Red: HSR < 3.5 , Frozen desserts.
Fish Cakes	No Brand Leaderbrand: Fish cakes Birdseye: Salmon cakes United: Fish cake hoki hash	Green Green Green Green	Average HSR of food group	"Fish and Other Seafood" Green: Processed fish with HSR ≥ 3.5 Amber: HSR of < 3.5 , ≤ 50 g in sandwiches, rolls, wraps or salads, ≤ 120 g as a meal
Fish Fingers	No Brand Sealord: Fish fingers Birdseye: Fish fingers Shore Mariner: Fish fingers Sealord: fish bites classic crumb Captins choice: Fish fingers	Green Green Green Green Green Green	Average HSR of food group	"Fish and Other Seafood" Green: Processed fish with HSR ≥ 3.5 Amber: HSR of < 3.5 , ≤ 50 g in sandwiches, rolls, wraps or salads, ≤ 120 g as a meal
Smoked Fish	No Brand Sealord: Fish fillet chunk style smoked Countdown: Tuna smoked John West: Tempers Tuna Naturally smoked Sealord: Sensations Salmon Smoked Flavour Countdown: Salmon naturally smoked United: Hoki cold smoked Smoky: Kawahi smoked	Green Green Green Green Green Green Green Green Green Amber Green	Average HSR of food group	"Fish and Other Seafood" Green: Processed fish with HSR ≥ 3.5 Amber: HSR of < 3.5 , ≤ 50 g in sandwiches, rolls, wraps or salads, ≤ 120 g as a meal
Smoked Chicken	No Brand Countdown: Smoked chicken breast Brinks: Smoked chicken breast	Green Green Green	Average HSR of food group	"Poultry" Green: Processed poultry with HSR ≥ 3.5 Amber: HSR of < 3.5 , ≤ 50 g in sandwiches, rolls, wraps or salads, ≤ 120 g as a meal
Chicken Nuggets	No Brand Leader: Chicken nugget battered Leader: Chicken nugget tempura battered Southern range: Chicken nugget battered Tegel: Chicken nugget battered	Green Green Green Amber Green	Average HSR of food group	"Poultry" Green: Processed poultry with HSR ≥ 3.5 Amber: HSR of < 3.5 , ≤ 50 g in sandwiches, rolls, wraps or salads, ≤ 120 g as a meal
Chicken Luncheon	No Brand Huttons: Ham & Chicken luncheon Southern range: Luncheon roll chicken Tegel: Chicken luncheon	Amber Amber Green Amber	Average HSR of food group	"Poultry" Green: Processed poultry with HSR ≥ 3.5 Amber: HSR of < 3.5 , ≤ 50 g in sandwiches, rolls, wraps or salads, ≤ 120 g as a meal
Chicken Pattie	No Brand Leader: Chicken pattie coat Southern Style Southern range: Chicken burger pattie Tegel: Chicken pattie crunchy Tegel: Chicken pattie grilled Tonys: Southern style chicken burger patties	Amber Amber Amber Green Green Amber	Average HSR of food group	"Poultry" Green: Processed poultry with HSR ≥ 3.5 Amber: HSR of < 3.5 , ≤ 50 g in sandwiches, rolls, wraps or salads, ≤ 120 g as a meal
Chicken Tenders	Tegel: Take outs Southern style chicken tenders tegel: crispy crumber tenders Tegel: Tandori chicken tenders Rangitikei: Thai style tenderloins Waitoa: Original free range chicken tenders	Green Green Green Green Green	Average HSR of food group	"Poultry" Green: Processed poultry with HSR ≥ 3.5 Amber: HSR of < 3.5 , ≤ 50 g in sandwiches, rolls, wraps or salads, ≤ 120 g as a meal

Chicken Schnitzel	No Brand	Green	Average HSR of food group	"Poultry" Green: Processed poultry with HSR ≥ 3.5 Amber: HSR of <3.5 , ≤ 50 g in sandwiches, rolls, wraps or salads, ≤ 120 g as a meal
	Smart Choice: Chicken schnitzel	Green		
	Tegel: Chicken schnitzel	Green		
	Tonys: Chicken schnitzel	Green		
	Watties: Chicken schnitzel	Green		
Shaved Red Meat	No Brand	Amber	Average HSR of food group	"Red Meat" Green: Processed meat with HSR ≥ 3.5 Amber: HSR of <3.5 , ≤ 50 g in sandwiches, rolls, wraps or salads, ≤ 120 g as a meal
	Countdown: Shaved ham	Amber		
	Hellers: Shaved champagne ham	Amber		
	Hellers: Shaved pork	Amber		
	Southern range: Ham Shaved Leg	Green		
Meatballs	No Brand	Amber	Average HSR of food group	"Red Meat" Green: Processed meat with HSR ≥ 3.5 Amber: HSR of <3.5 , ≤ 50 g in sandwiches, rolls, wraps or salads, ≤ 120 g as a meal
	Angel Bay: Gourmet meatballs	Amber		
	Angel Bay: Meat balls beef part cooked	Amber		
	Countdown: Beef & pork meatballs	Green		
	Hellers: Pork meatballs	Amber		
	Leader: Meatballs beef cocktail flame grilled	Amber		
	Leader: Meatballs beef premium school	Green		
Burger Patties	No Brand	Amber	Average HSR of food group	"Red Meat" Green: Processed meat with HSR ≥ 3.5 Amber: HSR of <3.5 , ≤ 50 g in sandwiches, rolls, wraps or salads, ≤ 120 g as a meal
	Angel bay: Beef burger 100g part cooked halal	Amber		
	Countdown: Prime NZ Beef burger patties	Amber		
	Hellers: Burger Patties Angus	Amber		
	Leader: Hamburger pattie fast cook	Green		
	Pacific Gold: Beef burger pattie raw	Amber		
	Rocket: Beef Burger Patties NZ	Green		
Misc. Red Meat Products	No Brand	Amber	Average HSR of food group	"Red Meat" Green: Processed meat with HSR ≥ 3.5 Amber: HSR of <3.5 , ≤ 50 g in sandwiches, rolls, wraps or salads, ≤ 120 g as a meal
	Countdown: Corned beef	Amber		
	Tonys: BBQ pork ribblet	Amber		
Falafel	No Brand	Amber	Average HSR of food group	"Legumes" All legumes 'green'; Defined guideline: processed legume products defined as 'green' if 75% or more. 'Amber' if HSR ≥ 3.5
	Dannys	Red		
	The cool gardener	Amber		
	Turkish kitchen	Red		
	Lisas: Middle Eastern mix	Amber		
	Lisas: Mediterranean mix	Amber		
	Wild chef	Amber		
Meat Alternative Patties	No Brand	Amber	Average HSR of food group	Defined guideline: 'Meat Alternative' Amber if HSR ≥ 3.5
	Bean supreme: Vegetarian burger patties	Amber		
	Beyond meat: Beyond burger pattie	Amber		
	Leader: Burger pattie vegetarian pre cooked	Red		
	Linda McCartney's: Vegetarian patties	Amber		
	Plan't: Smoky Chipotle burger patties	Red		
	Polaris: Pattie Vege Burger	Amber		
	The Alternative meat co: Burger pattie veggie	Amber		
	Veggie delights: Smoky BBQ burger patties	Amber		

Chicken Alternatives	No Brand	Amber	Average HSR of food group	Defined guideline: 'Meat Alternative' Amber if HSR ≥ 3.5
	Frys: Vegetarian burgers meat free chicken style	Amber		
	Plan*t: Chicken burger patties plant based	Red		
	Quorn: Vegetarian meal meat free soy pieces	Amber		
	Sunfed: Chicken free chicken original	Amber		
Mince Alternatives	No Brand	Amber	Average HSR of food group	Defined guideline: 'Meat Alternative' Amber if HSR ≥ 3.5
	Bean Supreme: Whole Food Mince	Amber		
	Bean supreme: Wholefood mince	Amber		
	Plan*t: Ground mince plant based	Red		
	Quorn: Vegetarian meal meat & soy free mince	Amber		
	Sunfed: Bull free beef	Amber		
	Veggie Delights: Casserole Mince Vegetarian	Amber		
	Veggie Delights: Meat alternative Nutmeat	Amber		
	No Brand	Amber		
	Bean Supreme: Vegetarian sausages	Amber		
Vegetarian Sausages	Linda McCartney's: Vegetarian sausages	Amber	Average HSR of food group	Defined guideline: 'Meat Alternative' Amber if HSR ≥ 3.5
	The Alternative Meat Co: Vegetarian sausages	Amber		
	Tonzu: Vegan sausages	Amber		
	Veggie Delights: Vegetarian hot dogs	Amber		
	No Brand	Amber		
Hummus	Countdown: Original Hummus	Amber	Average HSR of food group	"Legumes" All legumes 'green'; Defined guideline: processed legume products defined as 'green' if 75% or more. 'Amber' if HSR ≥ 3.5
	Greater Hummus: Roasted Garlic Humms	Amber		
	Just Hummus: Garlic & Lemon	Amber		
	Lisa's: Original Hummus	Amber		
	Obela: Hummus Smooth Classic	Green		
	Turkish Kitchen: Hummus Traditional	Amber		
	No Brand	Green		
Gaucamole	Countdown: Creamy guacamole dip	Amber	Average HSR of food group	Defined guideline: "Dips" defined as 'green' if 75% or more dairy/FVNL. 'Amber' if HSR ≥ 3.5
	Obela: Guacamole	Green		
Dips	No Brand	Red	Average HSR of food group	Defined guideline: "Dips" defined as 'green' if 75% or more dairy/FVNL. 'Amber' if HSR ≥ 3.5
	Lisa's: Feta & Spinach	Red		
	Obela: Tzatziki	Red		
	Turkish Kitchen: Fresh spinach & feta	Red		
		Red		

Chain Providers				
Chain	Menu Item	Rating	Justification	Guideline
Hells Pizza	Black Pizza	Red	All exceed portion guide for pies	"Mixed Meals" Green $\geq 75\%$ 'green' ingredients Amber No 'red' ingredients Red Contains 'red' ingredients OR does not contain any fruit or vegetables
	Blue Pizza	Red		
	Chicken Tenders W/ Garlic	Red		
	Mayo Dip	Red		
	Green Pizza	Amber		
	Red Pizza	Red		
	Slaw Salad + balsamic dressing	Green		
	Slaw salad + Caesar dressing	Green		
	Wedges w/ Sour Cream	Red		
	Yellow Pizza	Amber		
Jesters Pie	All	Red	All exceed portion guide for pies	"Baked Items" Red: Exceeds portion guide, Pies $\leq 140g$
Bakers Delight	Apple & Custard Scroll	Red		
	BBQ Pizza	Red		
	Berry Scroll	Red		
	Cheese & Bacon Savoury Rolls	Red		
	Cheesymite Scroll	Red		
	Chocolate Croissant	Red		
	Finger Bun: Hundreds & Thousands	Red		
	Finger Bun: Raspberry Icing	Red		
	Ham, Salami, Caramelised	Red		
	Onion Pockets	Red		
	Hawaiian Pizza	Amber		
	Mediterranean Pizza	Red		
	Spinach, Feta, Pesto (Vege)	Red		
	Pockets	Amber		

Subway	Vegetarian	Amber	6 INCH	"Sandwiches and Wraps" Green: Prepared w/ only green ingredients Amber: Prepared w/ green and amber ingredients. Red: Contains red ingredients Meat servings are based upon processed meat with a HSR <3.5. Must not exceed 50g. All bread is amber, 3x vege, 1 x protein listed, 1 x spread/condiment, 1 x cheese. Serving of meat based on https://www.subway.com/~media/New_Zeal_and/Documents/Nutritionals/NZ-Nutritional-Summary.pdf
	Tuna & Mayo	Amber	'Choose Your Own - Bread & GF Wrap (Based off 'average' Subway w/ 3 salad options, cheese & sauce)	
	Buffalo Chicken	Red		
	Chicken and Bacon Ranch Melt	Red		
	Chicken Classic	Red		
	Chicken Strips	Amber		
	Chicken Teriyaki	Amber		
	Three Pepper Chicken	Amber		
	Turkey, Sliced	Amber		
	Bacon, Streaky	Amber		
	Leg, Ham	Amber		
	Meatball Marinara	Red		
	Italian BMT	Red		
	Pepperoni	Red		
	Pizza Melt	Red		
	Pork Riblet	Red		
	Pulled Pork	Red		
	Roast Beef	Amber		
	Salami	Red		
	Steak, Diced	Red		
	Omelete	Amber		
	Veggie Patty	Amber		
	Falafel	Amber		
	Vegetarian	Amber	FOOT LONG	
	Tuna & Mayo	Amber	Choose Your Own - Bread & GF Wrap (Based off 'average' Subway w/ 3 salad options, cheese & sauce).	
	Buffalo Chicken	Red		
	Chicken and Bacon Ranch Melt	Red		
	Chicken Classic	Red		
	Chicken Strips	Amber		
	Chicken Teriyaki	Amber		
	Three Pepper Chicken	Amber		
	Turkey, Sliced	Amber		
	Bacon, Streaky	Amber		
	Leg, Ham	Red		
	Meatball Marinara	Red		
	Italian BMT	Red		
	Pepperoni	Red		
	Pizza Melt	Red		
	Pork Riblet	Red		
	Pulled Pork	Red		
	Roast Beef	Amber		
	Salami	Red		
	Steak, Diced	Red		
	Omelete	Amber		
	Veggie Patty	Amber		
	Falafel	Amber		
	Vegetarian	Amber	WRAP	
	Tuna & Mayo	Amber	Choose Your Own - Wrap (Based off 'average' Subway w/ 3 salad options, cheese & sauce)	
	Buffalo Chicken	Red		
	Chicken and Bacon Ranch Melt	Red		
	Chicken Classic	Red		
	Chicken Strips	Amber		
	Chicken Teriyaki	Amber		
	Three Pepper Chicken	Amber		
	Turkey, Sliced	Amber		
	Bacon, Streaky	Amber		
	Leg, Ham	Amber		
	Meatball Marinara	Red		
	Italian BMT	Red		
	Pepperoni	Red		
	Pizza Melt	Red		
	Pork Riblet	Red		
	Pulled Pork	Red		
	Roast Beef	Amber		
	Salami	Red		
	Steak, Diced	Red		
	Omelete	Amber		
	Veggie Patty	Amber		
	Falafel	Amber		
	Vegetarian	Amber	MINI Choose Your Own - (Based off 'average' Subway w/ 3 salad options, cheese & sauce)	
	Turkey, Sliced	Amber		
	Leg, Ham	Amber		
	Roast Beef	Amber		
	Chicken Strips	Amber		
	Ham	Amber	Salad bowl (Based off average salad w/ 4 vege options (green), sauce (amber), and protein (amber)) = mixed meal average 66% green items	
	Salami	Red		
	Beef strips	Amber		
	Tuna & Mayo	Amber		
	Vegetarian	Green		
	Apple & Custard Danish	Red		"Baked Items" Amber: Contains wholemeal flour, grains/fruit or vegetables. Red: Exceeds portion guide, has confectionary or icing
	Apricot & Custard Danish	Red		
	Boysenberry & Custard Danish	Red		
	Chocolate Chip Cookie	Red		
	Chocolate Chip Cookie w/ M&M's	Red		
	Double Chocolate Chip Cookie	Red		"Mixed Meals" Green ≥ 75% 'green' ingredients Amber No 'red' ingredients Red Contains 'red' ingredients OR does not contain any fruit or vegetables
	Oatmeal Raisin Cookie	Red		
	White Chip Macadamia	Red		
	Ultimate Cheesy Garlic Bread	Red		
	Toastie	Red		
	Ultimate Chicken & Pepperoni	Red		
	Cheesy Garlic Bread	Red		

Pita Pit	Black Bean Pattie	Amber	PETITA	<i>"Sandwiches and Wraps"</i> <i>Green: Prepared w/ only green ingredients</i> <i>Amber: Prepared w/ green and amber ingredients.</i> <i>Red: Contains red ingredients</i> <i>"Red Meat + Poultry"</i> <i>Green = Meat w/ fat remove, Mince w/ drained fat, Fresh or Frozen Poultry w/ fat removed OR Processed w/ a HSR >= 3.5</i> <i>Amber = Processed w/ a HSR of <3.5 and <= 50g in a sandwich</i> <i>Red: Meat where fat is not removed, Processed meat that does not meet Amber criteria</i>
	Feta & Quinoa Rosti	Amber	(Wholemeal, Plain + GF)	
	Garden Vege		'Choose Your Own (Based Off	
	Kumara & Lentil Rosti	Amber	a 'Regular' Pita Pit w/ 4 Veg,	
	Falafel	Amber	Sauce & Cheese)	
	Ham	Amber		
	Beef / Grilled steak	Amber		
	Bacon (fat visible)	Red		
	Grilled Lamb	Amber		
	Cabanossi Sausage	Amber		
	Eggs	Amber		
	Prawns	Amber		
	Chicken	Amber		
	Chicken - Teriyaki	Amber		
	Chicken Tenders	Amber		
	Marmite	Amber		
	Vegemite	Amber		
	Black Bean Pattie	Amber	REGULAR	
	Feta & Quinoa Rosti	Amber	(Wholemeal, Plain + GF)	
	Kumara & Lentil Rosti	Amber	'Choose Your Own (Based Off	
	Falafel	Amber	a 'Regular' Pita Pit w/ 4 Veg,	
	Ham	Red	Sauce & Cheese)	
	Beef / Grilled steak	Amber		
	Bacon	Red		
	Grilled Lamb	Amber		
	Cabanossi Sausage	Red		
	Eggs	Amber		
	Prawns	Amber		
	Chicken	Amber		
	Chicken - Teriyaki	Red		
	Chicken Tenders	Red		
	Marmite	Amber		
	Vegemite	Amber		
	Black Bean Pattie	Green	SALAD BOWL	
	Feta & Quinoa Rosti	Green	Salad Bowl	
	Kumara & Lentil Rosti	Green	Based off 'regular' bowl, mixed	
	Falafel	Green	meal w/ 4 Veg (Green), 1	
	Ham	Amber	Sauce (Amber), 1 Toppings	
	Beef / Grilled steak	Amber	(Green) + Protein	
	Bacon	Red		
	Grilled Lamb	Amber		
	Cabanossi Sausage	Amber		
	Eggs	Green		
	Prawns	Green		
	Chicken	Green		
	Chicken - Teriyaki	Amber		
	Chicken Tenders	Amber		
	Brownie	Red		
	Cookie	Red		
	Cookie Baked Choc Candy	Red		
	Ginger Crunch	Red		
	Grilled Wedges	Red		
	Loaded Pita Chips: Chicken	Amber		
	Loaded Pita Chips: Falafel	Amber		
	Loaded Wedges	Red		
	Pita Chips w/ Aoli Dipping sauce	Amber		

Local Providers				
Store	Menu Item	Rating	Justification	Guidelines
Sushi (Onigiri + Sushi Roll)	Chicken	Green		"Sushi"
	Chicken & Avocado	Green		Green: Prepared w/ mostly green ingredients.
	Tuna	Green		Amber: Other Sushi
	Tuna & Avocado	Green		Red: contains deep-fried ingredients
	Avocado	Green		
	Teriyaki Chicken	Amber		
	Teriyaki Chicken & Avocado	Green		
	Cream cheese + pineapple	Amber		
	Chicken Katsu	Red		
Bakery/Cafe	White Sandwich: Chicken & Vegetable	Amber		"Sandwiches and Wraps"
	White Sandwich: Chicken	Amber		Green: Prepared w/ only green ingredients
	White Sandwich: Ham & Vegetable	Amber		Amber: Prepared w/ green and amber ingredients.
	White Sandwich: Ham	Amber		Red: Contains red ingredients
	White Sandwich: Vegetable	Amber		
	Wholegrain/Brown Sandwich: Chicken & Vegetable	Amber		
	Wholegrain/Brown Sandwich: Ham & Vegetable	Amber		
	Filled Roll: Chicken & Vegetable	Amber		
	Filled Roll: Ham + Veg	Amber		
	Pie: Mince & Cheese	Red		"Baked Items"
	Pie: Mince	Red		Amber: Contains wholemeal flour, grains/fruit or vegetables.
	Pie: Steak & Cheese	Red		Red: Exceeds portion guide, has confectionary or icing
	Pie: Steak	Red		
	Pie: Bacon & Egg	Red		
	Pie: Mini Mince	Red		
	Sausage Roll	Red		
	Spinach Quiche	Amber		
	Ginger bread man	Red		
	Raspberry Lamington	Red		
	Chocolate Lamington	Red		
	Creamed Donut	Red		
	Hot Chips	Red		"Deep fried foods"
	Battered Hot Dog	Red		All Red
	Chicken Nuggets	Red		

PORTION GUIDE: Baked Items - Commercial			
	Guidelines for amber category	Average Serving	Category
Scones	≤ 100g	65-85g	Amber
Cake	≤ 100g	113g	Red
Loaf	≤ 100g	101g	Red
Muffin	≤ 100g	163g	Red
Waffle	<100g	90g	Amber
Pancake	≤ 100g	1 (68g)	Amber
Crumble	≤ 100g	100g	Amber
Banana bread	≤ 100g	110g-140g	Red
Slices (14)	≤ 80g	80g	Amber
Slice with filling (e.g. caramel)	≤ 80g	90g	Red
Pikelet	≤ 40g	1 (25g)	Amber
Biscuit (plain sweet)	≤ 40g	≤ 3 (34g)	Amber
Custard Square	<80g	115g	Red
Biscuit flavoured (shortbread, fruit filled, choc chip, anzac)	≤ 40g	≤ 2 (34g)	Amber
Small Pastries	≤ 60g	45g	Amber
Pie	≤ 140g	171g	Red
Quiche	≤ 140g	135g	Amber
PORTION GUIDE: Baked Items - Homemade			
Muffin	≤ 100g	Regular: 163g, Small: 110g	Red
Shortbread biscuit	≤ 40g	Regular: 39g, Small: 12g	Amber
Plain uniced biscuit	≤ 40g	Regular: 15g, Small: 7.5g	Amber
Brownie	≤ 100g	Regular: 98g	Amber

In-House Meals			In-House Meals		
Menu Item	Rating	Guidelines	Menu Item	Rating	Guidelines
Bean burger patties	Amber	<i>"Mixed Meals"</i> Green ≥ 75% 'green' ingredients Amber No 'red' ingredients Red Contains 'red' ingredients OR does not contain any fruit or vegetables	Pork fried rice	Amber	<i>"Mixed Meals"</i> Green ≥ 75% 'green' ingredients Amber No 'red' ingredients Red Contains 'red' ingredients OR does not contain any fruit or vegetables
Beef Nachos (no sourcream)	Red		Chicken Kebab on Rice	Amber	
Butter Chicken	Red		Chicken fried rice	Amber	
Casserole/stew	Amber		Smoked chicken and spinach fettucine	Red	
Cheese (Bechamel) sauce	Amber		Pesto and tomato pasta salad	Amber	
Chicken and avocado wraps	Amber		Mushroom and spinach fettucine	Red	
Chicken and vegetable pie	Amber		Pork and prawn dumpling (fat visible)	Red	
Chicken noodle soup with corn	Green		Chicken thai fried noodle	Green	
Chop suey	Green		Pizza bread	Amber	
Corn fritters	Amber		leek and potato soup (no cream)	Amber	
Cottage pie	Amber		chicken and vegetable soup	Green	
Fish pie (mashed potato top)	Green		tomato soup (no cream)	Amber	
Fried rice (Vegetarian)	Green		Leek and potato soup creamy	Red	
Frittata	Amber		pumpkin soup	Red	
Homemade ham pizza	Amber		pasta salad	Amber	
Jacket/Baked potato	Green		Feta and spinach roll	Amber	
Lasagna	Amber		Chicken and vegetable dumpling	Green	
Macaroni cheese (Amber <u>only</u> if vegetables included)	Amber		Coconut chia pot	Amber	
Mashed potato	Amber		Vietnamese spring rolls	Amber	
Meat loaf	Amber		Chicken chilli (curry)	Amber	
Mexican burrito bowl	Green		Vegetable lasagne	Amber	
Mouse trap	Red (no vegetable)		Mushroom pizza	Amber	
Pasta salad	Amber		Chicken pizza	Amber	
Pizza scrolls	Amber		Hawaiian Pizza	Amber	
Pork bun	Red (fat visible meat)		Vegetarian stir fry noodles	Amber	
Pork fried rice	Amber		Teriyaki Chicken Rice Ball	Red	
Pumpkin and kumara soup	Green		Rice Ball (Plain)	Red	
Roast (Chicken)	Green		Japanese Curry	Red	
Savoury mince	Amber		Meatlovers Pizza	Red	
Spagetti bolognese	Green		Chicken japanese curry with rice	Red	
Stirfry (Chicken)	Green		Chicken afridatta on rice	Green	
Thai Beef Salad	Amber		Onigiri (Teriyaki/Tuna)	Red	
Thai chicken noodle salad	Green		Seaweed Inari	Red	
Toasted sandwich (Cheese)	Amber		Springrolls (spring roll)	Red	
Tuna pasta bake	Amber		Teriyaki Chicken Donburi	Amber	
Vegetable soup with pasta	Green		Berry Fluff / Ambrosia	Red	
Vegetarian quiche	Amber		Chicken curry	Red	

Menu item categorisation							
Category	Questions						
Vegetables	Fresh, Frozen or Canned	Vegetable Product HSR ≥3.5	Category				
1							
Fruit	Fresh, Frozen or Canned	Canned w/ Fruit juice AND drained	Dried fruit ≥30 g	Fruit Product HSR ≥3.5	Category		
1							
Bread and crackers	Wholegrain, Wholemeal or Wheatmeal (1)	Pita bread (2)	Refined Cracker/Crispbread HSR ≥3.5	Category			
1							
Breakfast cereals	Weetabix, Porridge (3)	Wholegrain cereal HSR ≥ 3.5 and ≤ 15 g sugar per 100g	Other cereal HSR ≥ 3.5	Category			
1							
Other grains	Wholegrain	No flavouring	Category				
1							
Milk	Low fat	Plant milk fortified (5)	Unsweetened	Category			
1							
Milk Products	Low fat	Coconut cream, sour cream, cream cheese - low fat	Yoghurt, Custard ≤150g	Cheese ≤40g	Category		
1							
Legumes	All green						Category
1							
Nuts and Seeds	ELS - Any nuts & seeds	No Added Salt	No Added Sugar (6)	Salted Items, Nut mix w/ dried fruit ≤30g	Category		
1							
Fish and other seafood	Fresh (if Y - No other Q's required)	Frozen or Canned HSR ≥3.5 (if Y - No other Q's required)	≤50g in a Sandwich	≤120g in a Meal	Category		
1							
Poultry	Fresh (if Y - No other Q's required)	Processed w/ HSR ≥3.5* (if Y - No other Q's required)	≤50g in a Sandwich	≤120g in a Meal	Category		
1							
Red meat	Meat/Mince w/ fat removed (if Y - No other Q's required)	Processed Meat (11) HSR ≥3.5* (if Y - No other Q's required)	≤50g in a Sandwich	≤120g in a Meal	Category		
1							
Eggs	All green						Category
1							
Mixed Meals (see separate table)	% of Green items	% of Amber items	% of Red items	Contains Fruit or Vegetables	Category		
1							
Sandwiches and wraps	% of Green items	% of Amber items	% of Red items	Contains Fruit or Vegetables	Category		
1	0	100	0				
Sushi	Uses mostly green items	Deep Fried Items	Category				
1							
Fats, oils and spreads	No Added Salt (Spreads)	Vegetable oil used (N = Saturated fats)*	Butter ≤10g Portion	Category			
1							
Sauces and dressings	Reduced Fat	Reduced Sugar	Reduced Salt	Category			
1							
Sweet Condiment	Reduced Sugar	Category					
1							
Deep Fried Food	All Red						Category
1							
Packaged Snack Food	HSR ≥3.5 and ≤ 800 kJ per packet	Category					
1							
Confectionary	All Red (Includes: 'confectionary' includes boiled sweets, toffees, and caramels, fudge, fondants, gums (including sugar-free gums), pastilles and jellies, chocolate, fruit leathers, yoghurt-covered items, candied fruit and nuts, and compound chocolate)						Category
1							
Baked items	Contains wholemeal/wholegrain OR fruit (13) OR vegetable	Contains confectionary	No Icing	Muesli bars HSR ≥3.5	Portion Size (See Guide)	Sausage Roll	Category
1							
Drinks	Plain Water: Green		Milk - Use milk section to determine amber/green		All other drinks and smoothies: Red		Category
1							

Appendix 9: List of Assumptions and Justifications

To categorise ambiguous food items, a set of assumptions with supporting justifications was developed and agreed upon by four researchers (three nutritionists and one dietitian) to ensure consistency across menu analyses. These were used in the development of the menu analysis toolkit which was used to analyse school canteen menus for this thesis.

Assumptions	
Vegetables	
1	Where percentage of vegetable in a vegetable product not available, percentage is equal to the most similarly labelled product on the countdown website with this information available
2	Mixed vegetable', 'roasted vegetable', 'vegetable platter' and 'salad' are all equivalent to 3 vegetables (i.e. 3 ingredients)
3	All creamed corn has an HSR ≥ 3.5
4	Potato wedges and fries, oven baked from frozen, have a HSR ≥ 3.5
	Vegetables are defined as culinary form
Fruit	
5	Where percentage of fruit in a vegetable product not available, the percentage is equal to the most similarly labelled product on the countdown website with this information available
6	Canned fruit, when used as an ingredient in meals, is in natural juice that has been drained
7	Fruit salads and fruit platter contain three fruits where not otherwise salad
Breads and Crackers	
8	All bread (including pizza bases, pitas and wraps) is plain (white) unless stated otherwise
9	Plain bread is defined as containing less than 25% wholemeal flour/wholegrains and no dried fruit
10	Plain, wholemeal, wholegrain, wholewheat, wheatmeal and multigrain breads are served with a standard spread
11	Fruit bread is served with margarine
12	All wholemeal, wholegrain, wholewheat and wheatmeal breads have $\geq 5\text{g}$ fibre and $< 450\text{mg}$ sodium per 100g as per Foodworks analysis (27/04/22)
13	White pita bread is amber for schools based on Foodworks analysis (27/04/22)
14	Multigrain bread and crackers without a brand/recipe stated contain the following whole grains: kibbled rye and wheat (no pumpkin or sunflower seeds)
15	Pastry has a HSR of ≤ 3.5 (unless stated to be filo pastry which has a HSR of ≥ 3.5)
16	All fruit toast meets the amber category
Breakfast Cereals	
17	Weetabix and Porridge have a HSR ≥ 3.5 and $\leq 15\text{g}$ sugar per 100g based on Foodworks analysis (27/04/22)
18	All muesli (including bircher) has HSR of ≥ 3.5
19	All muesli (including bircher) contains dried fruit and/or nuts and/or seeds
20	Are served with milk unless otherwise stated
Other grains	
21	Rice is white unless otherwise stated
22	Grains are plain and unflavoured unless otherwise stated
Milk	

23	Milk is full fat (dark blue top) and unsweetened unless otherwise stated
24	Plant milks (soy, rice, almond and oat) are fortified with added calcium and B12
25	Coconut milk without a brand stated is unfortified
Milk Products	
26	Are full fat unless stated otherwise, with the exception of yoghurt (excluding Greek) which is assumed to be reduced fat
27	Are unflavoured unless stated otherwise
28	All yoghurts (reduced fat and regular) have a HSR ≥ 3.5
29	School aged+ children are served 1 pottle of yoghurt (125g) where not otherwise stated
30	All custard products have a HSR ≥ 3.5
31	Cheese is bakery blend where cheese type is not stated (category amber not considering portion sizes)
32	Cheese is 'pizza blend grated' where cheese type is not stated (category amber not considering portion sizes)
33	Feta is the 'creamy' not 'crumbly' type where not otherwise stated
34	The amount of cheese in sandwiches and meals does not exceed 40 g for schools
35	A serving of ice cream is one scoop (68g)
36	All ice cream products have a HSR < 3.5
Fish and seafood	
37	Tuna is canned and unflavoured unless otherwise stated
38	All frozen fish (including crumbed) has a HSR ≥ 3.5
39	All canned fish (including flavoured) has a HSR ≥ 3.5
Poultry (chicken and turkey)	
40	Fresh or frozen poultry with the fat removed is used in meals/sandwiches unless otherwise stated
41	All fresh and frozen poultry (including chicken nuggets and schnitzel) has a HSR ≥ 3.5
42	All smoked, shredded and roasted poultry has a HSR ≥ 3.5
43	All luncheon has a HSR < 3.5
Red meat (beef, lamb, pork)	
44	The fat has not been removed from meat if item is from a chain or community provider (otherwise it has)
45	The fat has not been drained from mince if item is from a chain or community provider (otherwise it has)
46	All processed/dried meat products meet amber based on nutrition assessment of Jack Links 600kj/packet (50g) or $< 300\text{kJ}/\text{stick}$ (12g) and Biltong 550kJ *
47	All shaved ham & pork has a HSR < 3.5
48	All pork ribblet has a HSR < 3.5
49	All meatballs have a HSR of < 3.5
50	All burger paddies have a HSR of < 3.5
51	Red meat schnitzel has a HSR ≥ 3.5
52	All salami and bacon products have 'visible fat'
53	The average portion size of red meat in a school meal is $\leq 120\text{g}$
54	The average portion size of red meat in a school sandwich is $\leq 50\text{g}$
Eggs	
55	Eggs prepared any style (scrambled, poached, fried, boiled) are green
Mixed meals	

56	Additional items including: Salt, Stock, Raising agents, Herbs, Spices, Zest, Cornflour, Vinegar are not counted as ingredients in mixed meals
57	Salads are served without dressing in ELS (exception of coleslaw, assumed to be made up with mayonnaise)
	Burgers are classified as sandwiches and consist of 1 x protein, 1 x condiment, 1 x plain bun, 1 x low-fat cheese, 3 x vegetable items
58	Nachos' contain corn chips unless otherwise stated
Sandwiches and wraps	
59	Contain a single serve of vegetable oil spread unless another spread/sauce is stated (exception burgers, contain a sauce instead)
60	Contain three vegetables if made by the school/ELS and two vegetables if made by children
Sushi	
61	Sushi includes sushi rolls and onigiri
62	Katsu/crumbed items are deep fried
63	Green sushi is made of mostly green ingredients, all other sushi is amber (i.e, processed meat, cream cheese). Sushi containing deep-fried products is red
Fats, oils and spreads	
64	Vegetable oil has been used as an ingredient in mixed meals with the exception of baked or air fried meals
65	≤ 10g of spread is used in sandwiches and meals
66	Spreads are vegetable oil based unless stated otherwise
Sauces and dressings	
67	Are not reduced fat, salt or sugar unless stated otherwise
68	Are served on the side (exception: chains e.g. pita pit and subway)
69	Include gravy
Sweet condiments	
70	Are served in portions less than ≤ 1 tablespoon (15g)
71	Include honey and sugar
Packaged snack foods	
72	HSR and kJ per packet content are as defined by the packaged snack food database
73	If brand name is not stated, the product falls into the common category (≤ 50%) for that snack item in the snack foods database
Confectionary	
74	Includes jelly
Baked Items	
75	Portion sizes of baked items are as defined by the portion size database unless portion size is provided
76	Wholemeal flour and wholegrains are not contained in baked items unless stated otherwise
77	Fruit or vegetables are not contained in baked items unless stated otherwise
78	The following baked items contain icing: buns, cakes, cupcakes, doughnuts, afghan cookies, slices (exception: oat-based slice/muesli slice), lamingtons
79	Family sized' pies baked inhouse with a protein source and vegetables are treated as mixed meal instead of baked item. These are assumed to be made with pastry unless stated to be Potato top, Shepherds, Cottage or Fish pie.
80	All muesli bars and slices contain either dried fruit and/or whole nuts or seeds and/or are hard to chew

81	All savoury scones contain at least one vegetable
82	All bliss balls contain over 30g of dried fruit
83	Anzac biscuits contain coconut which is a fruit

Justifications	
Vegetables	
1	Ingredient quantities likely to be similar. Countdown is a common supermarket, used for other justifications (consistency).
2	Commonality e.g. carrot, peas and corn for mixed vegetables, lettuce, tomato cucumber for a salad
3	See food database (average HSR)
4	See food database (average HSR)
Fruit	
5	Ingredient quantities likely to be similar. Countdown is a common supermarket, used for other justifications (consistency).
6	Dietetic judgement
7	Commonality
Breads and Crackers	
8	2002 NZ National Children's Nutrition survey "white bread was the most common bread type eaten by New Zealand children (79%)
9	Dietetic judgement
10	Dietetic judgement
11	Dietetic judgement
12	Foodworks analysis (27/04/22) of these products in the NZ Market
13	Foodworks analysis (27/04/22) of this product in the NZ Market
14	Tip Top multigrain bread ingredients as of 06/05: https://www.countdown.co.nz/shop/productdetailsstockcode=275523&name=tip-top-super-soft-toast-bread-multi-grain add crackers
15	See food database
16	See food database
Breakfast Cereals	
17	Foodworks analysis (27/04/22) of these products in the NZ Market
18	See food database (average HSR)
19	See food database
20	Commonality
Other grains	
21	Commonality
22	Most often used as ingredient in meals where other flavouring is being added
Milk	
23	2002 NZ National Children's Nutrition survey, "three quarters of children most frequently drank standard milk".
24	Soy milk most commonly used and most commonly fortified
25	Often canned
Milk Products	

26	Commonality
27	Dietetic judgement
28	See food database
29	Ease of service from school canteen and dietetic judgement
30	See food database
31	Reported by Heart Foundation Nutrition Advisor to be commonly used
32	Reported by Heart Foundation Nutrition Advisor to be commonly used
33	Commonality
34	Verified with judgement of Heart Foundation Nutrition Advisor due to cost of cheese
35	A serving of ice cream is one scoop (68g)
36	See food database
Fish and seafood	
37	Most often used as ingredient in meals where other flavouring is being added
38	See food database
39	See food database
Poultry (chicken and turkey)	
40	Dietetic judgement
41	See food database
42	See food database
43	See food database
Red meat (beef, lamb, pork)	
44	Dietetic judgement
45	Dietetic judgement
46	Foodworks analysis (27/04/22) of these products in the NZ Market
47	See food database (based on average HSR)
48	See food database (based on average HSR)
49	See food database (based on average HSR)
50	See food database (based on average HSR)
51	Similar in nutritional composition to poultry schnitzel
52	Production knowledge; blended with fat
53	Verified with judgement of Heart Foundation Nutrition Advisor
54	Verified with judgement of Heart Foundation Nutrition Advisor
Eggs	
55	Dietetic judgement
Mixed meals	
56	We do not have full recipes and these details are optional/suggestions on the guidelines
57	Dietetic judgement
58	Commonality
Sandwiches and wraps	
59	Dietetic judgement
60	Dietetic judgement
Sushi	
61	Dietetic judgement
62	Dietetic judgement
63	Green sushi is made of mostly green ingredients, all other sushi is amber (i.e, processed meat, cream cheese). Sushi that is deep fried will be red as this is in line with the guidance

Fats, oils and spreads	
64	Verified with judgement of Heart Foundation Nutrition Advisor
65	Dietetic judgement
66	2002 National Childrens Nutrition Survey "Margarine or margarine blend was more frequently spread on bread by New Zealand children (about half) than Butter (one in five)".
Sauces and dressings	
67	Commonality
68	Dietetic judgement
69	Likely made from powder not fat
Sweet condiments	
70	Dietetic judgement
71	Dietetic judgment of most suitable category
Packaged snack foods	
72	See food database
73	Dietetic judgement
Confectionary	
74	Dietetic judgement
Baked Items	
75	Dietetic judgement
76	Commonality
77	Commonality
78	Commonality
79	Portioning unknown, baked items category more suitable for individual items
80	Commonality
81	Commonality
82	Commonality
83	Commonality

Rules	
Rules - School	
1	If multiple flavours stated, count as individual items. If no flavour specified, count as one. For example: moosies (= 1 item), choc/banana/strawberry milk (= 3 item)
2	Combo meals are included as an overall item (treat as mixed meal). If the menu specifies that the items are also sold separately, classify the items as combo and individual items. If the menu does not specify the combo items being sold separately, only include the classification of the combo meal.
3	Count all varieties of a food group (e.g., four bean mix counted as four legumes) in a mixed meal
4	If multiple sizes are stated, count them as individual items (e.g., 'small' and 'large', or 'half wrap' and 'whole wrap')

Appendix 10: Food Policies and Practices Survey

Developed by the Massey University Healthy Active Learning Evaluation research team.

Schools and Kura - Food policies and practices survey 2022/23

Kia ora rā e hoa mā,

Thank you for taking the time to complete this survey.

The survey is part of a wider evaluation of Healthy Active Learning. The initiative, run by Health NZ, the Ministry of Education and Sport New Zealand, aims to improve the health and wellbeing of tamariki and rangatahi through healthy eating, drinking and quality physical activity. Results from the evaluation will help determine how to better support these aims. We are also seeking insights from ākonga and whānau.

The aim of this survey is to understand how schools and kura perceive their food and drink environments, what support has been received to help improve this environment, and where support may still be needed.

Questions in this survey are multiple choice with some free text options. The survey will take approximately 5-10 minutes to complete, and should be completed by a senior leader in your school or kura.

Please answer questions as accurately as you can. Your answers, and any details provided, will remain anonymous. Any data published from this survey will not identify you, your kura, or school by name.

Your full and honest participation is greatly appreciated and will help make a difference in the lives of tamariki and rangitahi.

Completing this survey and pressing submit will be interpreted as your consent to take part. If you do not give this consent, or do not want the evaluation team to analyse your results, please exit the questionnaire at any time prior to submitting and we will discard your answers.

Noho ora mai rā i roto i āku mihi maioha.

If you have any concerns or questions about this survey, please contact: Ajmol Ali, Massey University (a.ali@massey.ac.nz)

Q5 What is the official name of the school or kura where you work?

Q6 School or kura ID:

Q7 Where is your school or kura located (town / suburb)?

Q8 Which region is your school or kura in?

- ☐ Te Tai Tokerau / Northland (1)
- ☐ Tamaki Mākaaurau / Auckland (2)
- ☐ Waiariki / Bay of Plenty (3)
- ☐ Waikato (4)
- ☐ Tūranganui-a-Kiwa / Gisborne (5)
- ☐ Taranaki (6)
- ☐ Te Mātau-a-Maui / Hawkes Bay (7)
- ☐ Whanganui (8)
- ☐ Manawatū (9)
- ☐ Whanganui-a-Tara / Wellington (10)
- ☐ Te Tai o Aorere / Tasman/Buller (11)
- ☐ Waitaha / Canterbury – Te Tai Poutini / Westcoast (12)
- ☐ Ōtākou / Otago (13)
- ☐ Te Taurapa o Te Waka / Southland (14)

Q25 Type of school or kura:

- ☐ Contributing primary year 1 - 6 (1)
- ☐ Full primary year 1 - 8 (2)
- ☐ Intermediate school (3)
- ☐ Composite school year 1 - 13 (4)
- ☐ Composite school year 7 - 13 (5)
- ☐ Other (please specify) (6) _____

Q9 Does your school or kura have a healthy food and drink policy (for example, a formal policy set by the Board of Trustees)?

- ☐ Yes (1)
- ☐ No (2)
- ☐ No but would like to (3)
- ☐ Don't know (4)

Q10 Does the healthy food and drink policy stipulate "water and plain milk only" at school or kura?

- ☐ Yes (1)
- ☐ No (2)
- ☐ Don't know (3)

Q11 When was your healthy food and drink policy last reviewed and updated?

- ☐ Within in the past year (1)

- ☐ 1 - 3 years ago (2)
- ☐ 3 - 5 years ago (3)
- ☐ More than 5 years ago (4)
- ☐ Don't know (5)

**Q12 Who contributed to developing your school or kura healthy food and drink policy?
(Select all that apply)**

- ☐ School leadership (Principals, Deputy Principals, Lead Teachers) (1)
- ☐ Teachers (2)
- ☐ Canteen staff / chefs (3)
- ☐ Students (4)
- ☐ Whānau (5)
- ☐ Other (please specify) (6) _____

**Q13 How is information about the school or kura healthy food and drink policy
communicated with staff, students and others? (Select all that apply)**

- ☐ School newsletter (10)
- ☐ Staff meetings (11)
- ☐ Student Assemblies (12)
- ☐ Information seminars / Workshops (13)
- ☐ Email to staff, students and others (14)

- ☐ School website (15)
- ☐ Other (please specify) (16)

Q14 Indicate how much you agree or disagree with the following statement:

Our healthy food and drink policy is put into action in our school or kura (we implement the policy and ensure it is followed).

- ☐ Strongly disagree (1)
- ☐ Disagree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Agree (4)
- ☐ Strongly Agree (5)

Q15 Are you aware Health NZ has published a Healthy Food and Drink Guidance that provides advice on the types of food and drink that are made available in schools and kura?

- ☐ Yes (1)
- ☐ No, I am not aware of this guidance (2)

Q26 Are you aware Health NZ has published a Healthy Food and Drink Toolkit which contains resources for schools and kura to develop and implement healthy food and drink policies?

- ☐ Yes (1)
- ☐ No, I am not aware of this toolkit (2)

Q40 When thinking about the food and drink that is available in your school or kura, how much do you agree or disagree with the following statements?

Q39 Healthy items* are the main type of food and drink available (at least 75% of food and drink items are considered healthy).

**'Healthy items' are those that come from the four food groups (vegetables and fruit; grain foods, mostly wholegrain; milk and milk products, mostly low fat; and legumes, seafood, eggs, and meat); are generally lower in saturated fat, salt, and added sugar; and are mostly whole and less processed.*

- ☐ Strongly disagree (1)
- ☐ Disagree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Agree (4)
- ☐ Strongly agree (5)

Q42 Unhealthy items are not available, limited in offering, or being phased out.**

***'Unhealthy items' include those high in saturated fat, salt, and/or added sugar; with poor nutritional value; that are highly processed; and/or contribute to excess kilojoules/Calories. Examples include processed meats and sausages, deep fried foods, flavoured noodles, confectionery (lollies and chocolate), frozen desserts like ice cream, sweetened drinks, and all packaged foods with a Health Star Rating.*

- ☐ Strongly disagree (1)
- ☐ Disagree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Agree (4)
- ☐ Strongly agree (5)

Q21 How strongly do you agree with the following statement:

There are sufficient numbers of water fountains or water coolers at your school or kura.

- ☐ Strongly disagree (1)
- ☐ Disagree (2)
- ☐ Neither agree nor disagree (3)
- ☐ Agree (4)
- ☐ Strongly agree (5)

Q28 Does your school or kura enable access to food and drinks to students for activities including excursions, camps, athletics days and other school functions?

- ☐ Yes (1)
 - ☐ No (2)
 - ☐ No but would like to (please explain) (3)
-

- ☐ Don't know (4)

Q29 Does your school or kura promote healthy eating during school or kura hours?

☐ Yes (1)

☐ No (2)

☐ No but would like to (please explain) (3)

☐ Don't know (4)

Q30 Does your school or kura participate in a breakfast / lunch / food programme?

☐ Yes (1)

☐ No (2)

☐ Don't know (4)

Q31 Which programme(s) is your school or kura involved in? (Select all that apply)

- ☐ Fruit in schools (1)
 - ☐ Kick Start Breakfast (2)
 - ☐ Fonterra Milk in Schools (3)
 - ☐ KidsCan Food for Kids (4)
 - ☐ Ka Ora Ka Ako (Free and Healthy School Lunch Programme) (5)
 - ☐ Eat my lunch (6)
 - ☐ Feed the Need / Pātaka (7)
 - ☐ School / Community run breakfast club (8)
 - ☐ Other (please list) (9) _____
-

Q32 In the past five years, has your school or kura received support from any health promotion initiatives or groups to improve your food and drink environment? (select all that apply)

☐ Healthy Active Learning (including related initiatives such as Love Kai, Wave, Manawaekura). Note that this support comes from Public Health Units, District Health Boards, and/or Regional Sports Trusts (1)

☐ Heart Foundation (please specify) (2)

☐ Garden to Table (3)

☐ Oral health or dental groups (4)

☐ Community or school garden groups (5)

☐ Other initiatives or groups (please specify) (6)

☐ No (7)

☐ Don't know (8)

Q33 How has this support helped to improve any aspect of the food and drink environment within your school or kura? (Select all that apply)

☐ We developed or reviewed our healthy food and drink policy (1)

☐ We transitioned to a water-only (including plain milk) school (2)

☐ The food available is healthier (3)

☐ Staff, including teachers and food service staff, have improved knowledge of nutrition and healthy eating and drinking (4)

☐ Students have improved knowledge of nutrition and healthy eating and drinking (5)

☐ Students have been supported to play an active role in improving the food healthy food and drink environment in our school or kura (6)

☐ Whānau (parents and family) have been supported to play an active role in improving the food healthy food and drink environment in our school or kura (7)

☐ Other improvements (please specify) (8)

☐ Don't know (9)

Q34 On a scale from 1 to 5, how much do you think this support helped to improve the food and drink environment in your school or kura?

☐ 1 – Low improvement (1)

☐ 2 – Low/moderate improvement (2)

☐ 3 – Moderate improvement (3)

☐ 4 – Moderate/high improvement (4)

☐ 5 – High improvement (5)

☐ Don't know (6)

Q35 Do any food and beverage companies support your school or kura fundraising initiatives? (for example: students selling Cadbury chocolate)

☐ Yes (please list companies involved) (1)

☐ No (2)

☐ Don't know (3)

Q37 Are any of the following barriers preventing your school or kura from having a healthy food and drink environment? (select up to three)

- ☐ Resistance or disinterest from school leadership or teachers (1)
- ☐ Resistance or disinterest from parents (2)
- ☐ Resistance or disinterest from students (3)
- ☐ Loss of profit from the sale of unhealthy food and drink (4)
- ☐ Higher cost of healthier food and drink compared to unhealthier ones (5)
- ☐ Convenience and ease of preparation of processed and ready-to-eat food and drink (6)
- ☐ Lack of choice in options provided by the food service provider / lunch ordering system (7)
- ☐ Access issues to clean drinking water and/or sufficient water fountains (8)
- ☐ Lack of time or resources to make necessary changes (9)
- ☐ Lack of knowledge in nutrition and healthy eating to inform change (10)

Q38 Are there any other comments you would like to make about your school or kura food policies or practices?
