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**Prevalence of nutrition risk and associated risk factors among  
New Zealand (NZ) preschool children**

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

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in  
Nutrition and Dietetics**

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## Abstract

**Background:** There are limited studies on the prevalence of nutrition risk among preschool children (aged two to five years) living in New Zealand (NZ) as most studies focus on a broader age group which include younger and older children. This age group may be vulnerable to developing poor eating habits and inadequate nutrition intake during these years may have adverse health outcomes later in life.

**Objectives:** To determine the prevalence of nutrition risk using a validated nutrition screening tool Nutrition Screening Tool for Every Preschooler (NutriSTEP) among preschool children in NZ and to identify factors associated with nutrition risk.

**Method/Design:** An observational study design was used; we conducted a cross-sectional online survey using convenience sampling. Parents/caregivers of NZ preschool children (aged two to five years) completed an online survey which included NutriSTEP, parent and child height, weight and sociodemographic characteristics. The 17-item NutriSTEP responses were scored zero to four; item scores  $\geq 2$  indicate risk; maximum score 68. Participants were stratified into; low risk (NutriSTEP score  $\leq 20$ ) and moderate/high risk (NutriSTEP score  $> 20$ ) and associations between nutrition risk and sociodemographic characteristics were explored using a Pearson chi-square test and binary regression.

**Results:** Of 505 preschool children, 96 (19%) were at moderate to high risk (median IQR NutriSTEP score 24 [22,26]) and 409 (81%) were at low risk (median IQR NutriSTEP score 13 [10,16]). Preschool children at highest risk were non-NZ European ( $p=0.002$ ), of solo parents ( $p=0.002$ ), with household incomes  $\leq \$50,000$  ( $p \leq 0.021$ ) and non-university educated parents ( $p \leq 0.0001$ ). Of the NutriSTEP items,  $>30\%$  of preschoolers were at high risk for inadequate consumption of fruit, vegetables, grains, milk products, meat and meat alternatives, exposure to screens during meals and overuse of supplements.

**Conclusion:** A fifth of NZ preschool children were at moderate/high nutrition risk. Economic and ethnic disparities were apparent which suggests social inequity may increase nutrition risk in NZ preschool children. Prevalent nutrition risk factors were inadequate intakes of all major food groups, excessive screen-watching during meals and overuse of supplements. Using NutriSTEP may assist to identify NZ preschool children at highest nutrition risk who may benefit from appropriate nutrition support.

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## Abbreviations

Acronym	Full form
<b>BMI</b>	Body mass index
<b>Df</b>	Degrees of freedom
<b>FNGHYC</b>	Food and Nutrition Guidelines for Healthy Children and Young People 2-18 years, 2012
<b>GUiNZ</b>	Growing Up in New Zealand
<b>NutriSTEP</b>	Nutrition Screening Tool for Every Preschool (Nutrition Screening Tool)
<b>NZ</b>	New Zealand
<b>NZDep</b>	New Zealand Deprivation Index
<b>NZHS</b>	New Zealand Health Survey
<b>NZMoH</b>	New Zealand Ministry of Health
<b>OR</b>	Odds Ratio
<b>RDI</b>	Recommended Dietary Intake
<b>SPSS</b>	Statistical Package for the Social Sciences
<b>UK</b>	United Kingdom
<b>US or USA</b>	United States of America
<b>WHO</b>	World Health Organisation

## Definitions

**Preschooler** - A preschooler is a child aged two years or older (after the toddler years) who has not yet started school. In NZ, a child can start school from their fifth birthday and is legally required to attend school by their sixth birthday (Ministry of Health, 2010).

**Food Insecurity** – food scarcity; being unable to obtain food or being uncertain whether food can be obtained to meet personal and family requirements.

**Neophobia** – the fear or anything new or unfamiliar.

**Nutrition Risk** – the individual risk of not meeting nutritional requirements through food eaten or the risk of developing nutrition related disease or deficiencies.

**Nutrition Screening** - “a process to identify an individual who is malnourished or who is at risk for malnutrition to determine if a detailed nutrition assessment is indicated” (American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.), 2010).

## 1. Chapter 1: Introduction

### 1.1. Background

Children with impaired nutrition status in early childhood are at higher risk of impaired growth and development (Owino et al., 2019, Hoffman and Klein, 2012), reduced cognitive function (Laus et al., 2011, Goyal Manu et al., 2015), an increased risk of nutrition related disease and are more likely to be overweight or obese (Daniels, 2009, Morton et al., 2017, Krushnapriya et al., 2015). Identifying those at high nutrition risk is the first step to providing appropriate dietary intervention and access to services provided by Dietitians and other health professionals.

Nutrition risk is defined as “the presence of characteristics or risk factors that can lead to impaired nutritional status” (American Dietetic Association, 1994). The short-term consequences to children with poor nutrition habits and high nutrition risk include inadequate energy and nutrition intake, which can lead to impaired growth and development (Owino et al., 2019, Hoffman and Klein, 2012), impaired social development (Liu and Raine, 2017), poor oral health (Çolak et al., 2013), weight gain (Morton et al., 2017) and poor sleeping patterns (Chaput et al., 2018). In addition, sedentary behaviours and inadequate physical activity may contribute to weight gain (Morton et al., 2017), impaired development of motor skills (van Beurden et al., 2008) and low bone density (Specker et al., 2015).

Long-term implications of poor nutrition habits in childhood which carry on into adulthood are an increased risk of nutrition-related diseases such as cancer, ischaemic heart disease, type 2 diabetes and colon cancer (Daniels, 2009) and is estimated to be a contributing factor in two out of every five deaths in the NZ population (Ministry of Health, 2003a). Being overweight as a child may lead to obesity as an adult and an increased risk of developing nutrition related disease (Daniels, 2009). Therefore, addressing nutrition risk in NZ preschoolers may ultimately help reduce obesity rates and the incidence of nutrition-related disease in NZ adults.

Nutrition related disease in later life may also place a significant burden on the health care system. It has been estimated that overweight and obesity cost NZ\$624 million (4.4%) of the NZ Government’s total health care expenditure per annum, plus additional costs for loss of productivity (Lal et al., 2012). The NZ population is expected to grow from 4.69 million in 2016 to 5.8 million in the year 2038 and life expectancy is increasing (Stats NZ, 2016). Additionally,

diet-related diseases such as type 2 diabetes are being diagnosed at younger ages (Sjardin et al., 2018). These combining factors will place a further burden on the health care system.

NZ experiences a high prevalence of ethnic and economic health inequality. Oral health and obesity are some of the most prevalent health conditions in NZ children with the highest rates among Māori and Pacific children, living in low socioeconomic households (Ministry of Health, 2012b, Gerritsen et al., 2018). Similarly, Māori and Pacific adults living in areas of highest deprivation have the highest rates of obesity and nutrition related disease (Morton et al., 2017). Food insecurity is defined as *“Limited or uncertain availability of nutritionally adequate and safe foods, or the limited or uncertain ability to acquire such foods in a socially acceptable way”* (Ministry of Health, 2012a) and may have a negative impact on healthy food intake. Population studies in NZ have found that children from households who are food insecure have a lower intake of fruit and vegetables (Smith et al., 2013, Ministry of Health, 2019b, Parnell and Gray, 2014) and are more likely to consume fast food and sugary beverages more than three times per week (Ministry of Health, 2019b). Fast food and sugary beverages are often calorie dense, high in saturated fat and sugar, and low in nutrients, and frequent intake is associated with an increased risk of overweight and obesity in preschool children (Anderson et al., 2016, Rosenheck, 2008).

In addition to socioeconomic factors, the household environment and family behaviours impact nutrition intake and dietary habits in children (Gerritsen et al., 2018, Sirasa et al., 2019). Studies on families in NZ found nutrition-related behaviours such as eating breakfast at home; encouraging balance and variety; positive parental role modelling; eating together as a family and not watching screens or television have been found to be positively associated with children developing healthy nutrition habits and eating patterns (Gerritsen et al., 2018). Furthermore, a systematic review of 14 peer reviewed studies on family behaviours and child nutrition in low to middle income countries (as defined by the 2017 per capita gross national income (GNI)) consistently found a positive association between children having a healthy diet and family nutrition knowledge, income and household food availability (Sirasa et al., 2019, Rosenheck, 2008).

Identifying children most at risk allows for interventions to be targeted to those most in need. Being able to apply targeted interventions, at an age appropriate level may assist with adjusting nutrition habits and behaviours in preschool years before poor nutrition habits become deep rooted and prior to the onset of nutrition-related disease. This study will add to

current literature on nutrition risk in NZ preschool children and will use a validated nutrition screening tool that was adapted to the NZ setting and tested for reliability, to explore factors associated with increased nutrition risk in NZ preschool children.

Using a validated and reliable screening tool allows for nutrition habits and behaviours to be assessed to establish a nutrition risk score. It allows for the evaluation of upstream and early determinants that can influence nutrition status and makes it possible to take early preventative measures to prevent the onset of under or overnutrition. The adapted and tested NZ version of the Nutrition Screening Tool for Every Preschooler (“NutriSTEP”) will be used as the research tool for this study (Edge, 2019). NutriSTEP includes 17 items to assess the child’s usual intake of main food groups (grains, dairy, protein, vegetables, fruit, fast food, drinks) and healthy behaviours (screen time, eating difficulties, eating patterns, portion sizes, supplements and physical activity). Parents and caregivers complete the 17-item tool, where each item has a score between zero and four (with a maximum of 68). Children with a score less than 20 are at “low risk” and a score over 20 are considered “moderate/high risk”.

There is currently no widely used nutrition screening tool for preschool children in NZ and the use of NutriSTEP in this study provides an opportunity to use an adapted, validated and reliable screening tool among a sample of NZ preschool children and to assess the potential for its future use in community-settings. In addition, this study will assist with understanding factors relating to nutrition risk in NZ preschool children. The conceptual framework (**Figure 1**), outlines the sociodemographic factors investigated in this study that are hypothesised to be associated with nutrition risk. In addition to the factors in the conceptual framework we will also investigate the prevalence of nutrition risk in NZ preschool children and dietary and sociodemographic factors which contribute most to nutrition risk.



\*denotes independent variable.

**Figure 1.1 Conceptual framework of sociodemographic factors hypothesised to be associated with nutrition risk**

The purpose of this study is to explore the prevalence of nutrition risk in NZ preschool children (aged two to five years) and associated risk factors. Identifying sociodemographic characteristics which are associated with high nutrition risk is essential to understand how these factors impact the nutrition habits of NZ preschool children and to develop strategies to improve preschool children's eating habits.

## 1.2. Aims and Objectives

### Aim:

The aim of this study is to explore the prevalence of nutrition risk in NZ preschool children (two to five years) and factors associated with nutrition risk.

### Objectives:

- To identify the prevalence of nutrition risk among preschool children (aged two to five) using a valid and reliable screening tool “Nutrition Screening Tool for Every Preschooler” (NutriSTEP).
- To investigate whether sociodemographic factors, such as age, gender, deprivation index, income, parent/caregiver education level, household size, ethnicity and geographical location, are associated with low or moderate to high nutrition risk in NZ preschool children.
- To identify key risk responses that contribute to nutrition risk among NZ preschool children.

## 1.3. Contributors to the Research

Contributor	Contribution to thesis
Helen Ross	Ethics application, recruited participants, data collection, processing and analysis, conducted statistical analyses, results interpretation, author of the thesis
Professor Carol Wham	Main supervisor, study design and methodology, ethical application, assisted with data analysis and interpretation of results, revision and approval of thesis
A/Prof Rozanne Kruger	Co-supervisor, study design and methodology, ethical application, assisted with data analysis and interpretation of results, revision and approval of thesis

#### 1.4. Structure of the thesis

This thesis is composed of four chapters and appendix A and B.

**Chapter 1** includes the introduction, outline of the study and justification for conducting this study. **Chapter 2** includes the literature review and discusses the findings from similar research on nutrition habits of preschool children in NZ and overseas. This literature reviews formulates the basis for this research. The following databases were searched: Web of Science, Google Scholar and Discover. Relevant keywords were searched to find similar relevant research. The search keywords included: preschool nutrition; NZ child nutrition; NZ preschooler nutrition; NutriSTEP; child malnutrition; nutrition 2-5 years; preschooler nutrition habits.

**Chapter 3** is the manuscript for this research and has been formatted for submission to the Journal of Paediatrics and Child Health. The manuscript has 6 parts: abstract, introduction, methods, results and discussion.

**Chapter 4** is the final conclusion for the research and includes strengths, limitations and future recommendations.



## 2. Chapter 2: Literature Review

### 2.1. Introduction

Impaired nutritional status during infancy and early childhood may be associated with nutrient deficiencies and both short- and long-term health consequences such as poor growth and development, obesity and nutrition related disease (Gerritsen et al., 2018). Poor nutrition habits in childhood can have short- and long-term consequences to social development (Liu and Raine, 2017) and cognitive function (Laus et al., 2011, Goyal Manu et al., 2015). Nutrition screening is an essential first step to identifying those at highest nutrition risk with poor nutrition habits who may benefit from further assessment and nutrition interventions.

This literature review seeks to address the current status of NZ preschool age children with regards to health, nutrition, physical activity and eating patterns. It discusses the impact of social factors such as social economic status, food security, household environment, neophobia, screen time and physical activity on overall health and wellbeing. Understanding how these factors influence nutrition intake, dietary patterns and health behaviours can assist to target nutrition and physical activity interventions to improve the health of preschool children most at need.

The NutriSTEP (“Nutrition Screening for Every Preschooler”) questionnaire is a useful tool to assess risk factors among NZ preschool children. NutriSTEP has been developed in Canada and adapted and tested for reliability in the NZ population (Edge, 2019). In addition, has been found to be reliable for use as an online and in-person survey (Carducci et al., 2015, Randall Simpson et al., 2008).

### 2.2. The Health of New Zealand Children

The most prevalent nutrition related health issues among in NZ children are oral health and obesity; Māori and Pacific children and those from lower socioeconomic backgrounds are most at risk (Ministry of Health, 2012b).

#### 2.2.1. Oral Health

Sugary foods and drinks are linked to an increase in poor oral health and tooth decay (Thornley et al., 2017). In Growing up in New Zealand (GUiNZ), a longitudinal study following over 6,000 NZ children from birth to early adulthood, 43% of four year olds ate confectionary, lollies or

chocolate once or twice a week (Morton et al., 2017), which is contrary to the NZMoH recommendation of less than once a week (Ministry of Health, 2012a). Tooth extraction due to decay is more prevalent amongst children five to nine years old (8%), however, approximately 1% of NZ children under five years have teeth extracted due to decay (Ministry of Health, 2012b). Recent research indicates dental caries are linked to an increased risk of rheumatic fever (Thornley et al., 2017). In NZ, Māori and Pacific children have the highest rates of rheumatic fever, which are 20-37 times higher than in NZ European children (Jarman, 2011)

### 2.2.2. Obesity

Obesity is one of the leading health concerns for NZ children (Ministry of Health, 2012b) and increases the risk of developing non-communicable diseases such as type 2 diabetes, hypertension, cardiovascular disease, pulmonary disease, hepatic, renal and musculoskeletal health issues later in life (Ministry of Health, 2003a). Obesity rates in NZ children have been steadily increasing. In the 2006/2007 NZHS, 8.4% of children aged two to 14 were obese. In 2016/2017 this had risen to 12.3% (Ministry of Health, 2017a). Nutrition habits and behaviours develop early in life and being overweight or obese during the preschool years, increases a child's risk of being overweight or obese as an adult (Gerritsen et al., 2018). A systematic review of global childhood obesity studies found that half to two-thirds of obese children become obese adults (Singh et al., 2008). With that comes the increased risk of nutrition related disease and poor health outcomes associated with obesity. Dietary factors and sedentary behaviours such as a high intake of sugary drinks, low physical activity, high rates of screen time and a high intake of takeaways are positively associated with obesity (Morton et al., 2017, Porter, 2019). The GUiNZ study found almost half (49.5%) of four-year-old children who were overweight or obese had sugary beverages once a week or more (Morton et al., 2017). Non-NZ European Māori and Pacific children aged two to 14 years old were found to less likely meet dietary recommendations than NZ European children in the NZHS 20017/2018 including having an excessive consumption of fast food and sugary beverages; Pacific and Asian children were less likely to meet fruit and vegetable recommendations (Ministry of Health, 2017a, Ministry of Health, 2010). This is important because a high intake of energy, fat and sugary foods is associated with an increased risk of obesity (Morton et al., 2017). There were 13% of four-year olds in GUiNZ who were overweight or obese with the highest rates amongst Māori (21% overweight or obese) and Pacific children (33% overweight or obese) (Morton et al., 2017). Being overweight or obese is not the only challenge to NZ children, the 2006/2007

survey found that 2.9% of two to 14-year olds were underweight which was three times more prevalent in Asian children (Ministry of Health, 2008).

Preschool aged children aged two to four years have an average BMI of 17.2kg/m<sup>2</sup> for both boys and girls (Ministry of Health, 2008), whilst 7.6% of males and 9.1% of females aged two to four years are overweight (Ministry of Health, 2008). Identifying and intervening to improve obesogenic behaviours such as a high energy, fat and sugar intakes, irregular eating patterns and sedentary behaviours may assist in reducing obesity rates in children.

### 2.3. Nutrition and Behaviour

The rates of diagnosed behaviour problems in NZ children has increased from 1.8% in 2006/2007 to 3.2% in 2011/2012 (Ministry of Health, 2012b). Behaviour problems include depression, anxiety and attention deficit and hyperactivity disorder. Mental health issues may influence nutritional intake particularly if children have neophobic tendencies which can result in picky and fussy eating (Benton, 2004). Neophobic tendencies and altered dietary patterns may occur alongside other behavioural/mental health problems or sensory issues such as autism, attention deficit disorder and hyperactivity (Wallace et al., 2018, Chou et al., 2018). Neophobia is more prevalent during early childhood and rates decline with age (Benton, 2004). Limited food exposure and neophobic tendencies in preschool years may reduce variety of food intake.

Parenting styles, eating behaviours of parents and caregivers and learned behaviours may influence eating behaviours in children. Several studies show a link between maternal eating habits and dietary intake of preschool children (Russell et al., 2016). Mother's food likes and dislikes can influence which foods children are exposed to and parents who are aware of the health benefits of a nutritious diet such as having adequate fruit and vegetables are more likely to provide healthy food for their child (Russell et al., 2016). In NZ, a study on 1185 children aged 45 months, found that only 4% regularly and consistently experienced recommended nutrition-related behaviours at home and school. Recommended nutrition-related behaviours include "eating breakfast at home; encouraging balance and variety; positive parental role modelling; eating together as a family; not watching screens or television during meals" (Gerritsen et al., 2018).

Poor nutrition in the early years can impact cognitive ability and can result in impaired social behaviours and cognitive function (Liu and Raine, 2017). There is a clear relationship between

nutrition and school performance and the long-term impact of poor nutrition in childhood can last into adulthood (Scrimshaw, 1998). For children to reach their potential they need adequate nutrition. Childhood micronutrient deficiencies can have short- and long-term consequences to academic performance and cognitive function (Laus et al., 2011, Goyal Manu et al., 2015).

The long-term effect of poor nutritional status is difficult to study due to the ethical issues with identifying poor nutrition status or malnutrition and then continuing with studies rather than providing treatment. However, a longitudinal study initiated in 1972 on 1795 children aged three years old in living in Mauritius found that poor nutritional status resulted in impaired social function (Liu and Raine, 2017). The study identified poor nutrition markers in children: *Angular stomatitis (an indicator of niacin and vitamin B2 deficiency); Thinning hair (an indicator of protein malnutrition); hair dyspigmentation (also an indicator of protein malnutrition); and anaemia (an indicator of poor iron intake)*. Social behaviour was measured based on each child's score for exploratory play, extent of verbalisation, friendliness and active social play. The study found that children with malnutrition markers at aged three positively correlated with impaired social behaviour. The correlation was still significant after taking into account parental education and social adversity (Liu and Raine, 2017). Furthermore, the study found that poor nutrition negatively impacted areas of the brain which are involved in cognitive development of social behaviours (Liu and Raine, 2017).

#### 2.4. Sociodemographic factors and nutrition

Poor nutrition habits in children can result from medical, social or behavioural factors such as ethnicity, household environment, food insecurity, limited food options, household income, parental education, parents' nutrition behaviours and fussy eating (neophobia) (Walton et al., 2009, Wallace et al., 2018, Lang and Rayner, 2005). Understanding which medical, social or behavioural factors have the greatest impact on nutrition risk can assist with the development of nutrition interventions in children.

Ethnic disparities are apparent in NZ, with Māori and Pacific children most at risk of being overweight (compared to non-Māori/non-Pacific children) (Ministry of Health, 2008) and Asian children are more likely to be underweight (Ministry of Health, 2008). In a recent NZ study among 180 parents of children aged six months to five years, which explored parental perceptions on determinants of obesity in children, Pacific Island and Indian parents voiced that a loss of culture and lack of culturally appropriate nutrition education and support were

influencing obesity rates in their culture. Some Pacific and Indian participants voiced that the integration into NZ society had resulted in a shift from their traditional diets towards less healthy westernised foods. Māori and NZ European parents did not express these same concerns. However, parents from all ethnicities rejected the stereotype that culture is to blame for obesity rates and reported that the cost of food, limited time to prepare meals and ease of access to takeaways were the most prevalent barriers to preparing healthy food for their child. (Marewa et al., 2019).

Additionally, NZ children living in low socioeconomic populations are 2.5 times more likely to be obese than children from less deprived populations (Ministry of Health, 2017a). In general, children from low income households are more likely to have poorer nutrition, including low intakes of fruit and vegetables, higher intakes of fast food and sugary beverages and be less physically active (Ministry of Health, 2019b, Smith et al., 2013, Parnell and Gray, 2014, Carter et al., 2010).

The NZ Children's Food and Drink Survey (2007) reports that 96% of households in the least deprived areas have fruit frequently available compared to only 81% of households in more deprived areas. Fresh vegetables were reported as frequently available in 84% of households in less deprived areas compared to 69% of households in the most deprived areas (Health Sponsorship Council, 2008). The NZHS 2018/2019 reports that almost two-thirds (64.4%) of children living in the most deprived areas were not meeting their daily fruit and vegetable intake recommendations. Although the children in the most deprived areas had the lowest intakes of fruit and vegetables the survey also identified that children from least deprived households also had low intakes of fruit and vegetables with only half (50.8%) of children in least deprived areas consuming minimum serves of fruit and vegetables per day (Ministry of Health, 2019a). Children living in the most deprived areas are two times more likely to exceed recommended amounts of fast food and fizzy drink compared to those living in less deprived areas (Ministry of Health, 2019a). The Children Food and Drink Survey (2007) reported consumption of fruit juice varies across deprivation indices in NZ, with children from least deprived households more likely to have fruit juice available daily (35%) compared to children living in the most deprived households (18%). Additionally, children from the most deprived households are more likely to have full fat milk available daily (68%) compared to children from the least deprived households (50%) and children from the least deprived households are more likely to have low fat milk available daily (73%) compared to children from the most deprived households (39%) (Health Sponsorship Council, 2008).

Food insecurity is more prevalent in Māori and Pacific Islanders, household with low incomes and single parent families (Carter et al., 2010, Hopgood et al., 2010, Segedin, 2003, Parnell and Gray, 2014). In a study on 183 Auckland children aged one to 14 years old, food insecure preschoolers were at higher risk of not meeting their recommended dietary intake (RDI) for vitamin E, calcium and selenium when compared to food secure preschool children (Segedin, 2003). Further studies have found those living with or at risk of food insecurity often restrict fruit and vegetable intake first (Parnell and Gray, 2014) and have a high incidence of deficiencies and lower intakes of fructose, glucose, vitamin C, vitamin A, vitamin B6 and fibre (Parnell and Gray, 2014), which are key nutrients in many fruit and vegetables. In addition, food insecurity has been linked to a range of health issues in children such as cognitive issues, anxiety, anaemia, and aggression (Gundersen and Seligman, 2017).

In addition to household income, the composition of the household a child lives in may also influence nutrition risk. Children of single parents are less likely to eat breakfast, meet recommendations for frequency of meals and less likely to have family dinners (Parikka et al., 2018). In a large study in the United States of America (USA) of 5194 children aged two to five years old found those living with single mothers were more likely to experience food insecurity, have more screen time and had a higher fat intake compared to children of two parent families (Bowman and Harris, 2003). Previous studies in NZ exploring the relationship between food insecurity and obesity have found that children from households with three or more children were more likely to be food insecure and be overweight or obese (Walton et al., 2009). Children from larger households with low income were at increased risk of food insecurity. The more children living in a household, the greater the risk of food insecurity (Dunifon and Kowaleski-Jones, 2003, Ministry of Health, 2019b).

International studies have found a lower maternal education is associated with poorer nutrition habits (van Ansem et al., 2014, Iftikhar et al., 2017). Children of higher educated mothers consumed more serves of fruit and vegetables and were more likely to eat breakfast compared to children with less educated mothers (van Ansem et al., 2014). Although there is limited research of this nature in NZ, this indicates there may be a relationship between nutrition risk and parental education.

A large study on 12,888 children aged zero to five years and living in Egypt reported that children of working mothers were more likely to have a poor nutritional status (Rashad and Sharaf, 2019). A similar study in the United Kingdom found that preschool children of mothers who work part or full time were more likely to have sugary beverages and watch two or more

hours of television per day, and were less likely to have fruit and vegetables as snacks and less likely to have fruit three or more times per day (The Millennium Cohort Study Child Health Group et al., 2009). However, these findings are in contrast to research in the USA which suggests that maternal employment is positively associated with beneficial effects on a child's weight (Oddo et al., 2017). There are no similar studies in NZ.

## 2.5. Nutrition habits of New Zealand children

There is limited data on nutrition habits of preschool children in NZ as most national nutrition surveys are on younger or older children or not stratified into the specific two to five year age group. In general, we know NZ children aged two-18 years regularly consume high fat and high sugar foods, less than half (40%) are meeting recommended vegetable serves per day, just under one third are not meeting their daily fruit requirements, approximately 10% skip breakfast, most (94-98%) consume milk and nearly all consume bread every day (Ministry of Health, 2012a).

### 2.5.1. Grain and grain products

Grains provide fibre, vitamins and minerals and they are an important source of energy for the body (Ministry of Health, 2017b). The current New Zealand Ministry of Health (NZMoH) recommendations for preschool children is to have at least 4 serves of grain and grain products per day (Ministry of Health, 2017b). In one study among 550 NZ preschool children aged three and half years, just 7% of the children had the recommended four or more serves of grains per day. In addition, children who were meeting the recommended serves of grains per day were found to have significantly higher IQ's ( $p=0.03$ ) compared to children who were not meeting the requirement. However, this finding was not significant once it was adjusted for confounding factors (gestation, parity, gender, parental occupation, maternal school leaving age, parental marital status, mothers BMI, child's BMI at 3.5yrs) ( $p=0.20$ ) (Theodore et al., 2009).

### 2.5.2. Milk and Milk Products

The current recommendation for preschool children in NZ is to have at least two to three serves of milk or milk products every day (Ministry of Health, 2017b), to provide enough energy, protein, vitamins and minerals, including calcium (Ministry of Health, 2017b). A low calcium intake can result in poor bone density and poor tooth mineralisation (Ministry of Health, 2012a). Calcium is also essential for nerve conductivity, blood clotting, regulating

muscle contraction along with playing a role in other bodily functions (Ministry of Health, 2012a). In NZ, 96% of children aged five and six meet the minimum daily requirement of 700mg of calcium per day (Ministry of Health, 2003). There is limited data on actual calcium intakes in NZ preschool children however in one study on 550 NZ preschool children, the majority (86%) were meeting their minimum daily serves of milk and milk products (Theodore et al., 2006).

### 2.5.3. Fruit and Vegetable Intake

Two serves of vegetables and two serves of fruit per day are the minimum servings recommended by the NZMoH for preschool children (Ministry of Health, 2012a). Having two serves of fruit and two serves of vegetables per day is important to meet vitamin, mineral and fibre requirements as well as obtain additional benefits from antioxidants present in fruit and vegetables (Slavin and Lloyd, 2012).

GUINZ found that just over half of the four-year-old children (54%) consumed at least two serves of fruit and two serves of vegetables per day (Morton et al., 2017) suggesting nearly half (46%) of NZ children may not be meeting the minimum fruit and vegetable servings per day. This is similar to the findings in the National Survey of Children and Young People's Physical Activity and Dietary Behaviours in NZ 2008/2009 for the five to 24-year-old age group where 40% were meeting their minimum vegetable intake per day and 69% were meeting their fruit intake per day (Ministry of Health, 2010).

### 2.5.4. Meat, fish, poultry or alternatives

The NZMoH recommends that preschool children have at least one serving of meat, fish, poultry or alternatives per day (Ministry of Health, 2017b). An inadequate meat intake may increase the risk of iron-deficiency anaemia. Random population studies on Auckland children under two years old found 14% to be anaemic and the highest rates of anaemia were among Māori, Pacific and other non-European ethnicities (Grant et al., 2007b). An earlier study in 1998 to 1999 in Dunedin and Invercargill, found iron deficiency anaemia was rare but suboptimal iron levels and low ferritin levels occurred in 29% of participants aged six to 24 months (Soh et al., 2004). Iron deficiency in infancy and early childhood has negative implications to health particularly to cognitive function and learning ability (Grant et al., 2007a). Anaemia can also impact social behaviour in children (Liu and Raine, 2017). Having an



adequate intake of iron containing foods such as meat and meat alternatives may lower the risk of developing iron deficiency anaemia.

#### 2.5.5. Fast food

The current recommendation from the NZMoH is to have takeaways less than once a week (Ministry of Health, 2017b). In NZ, 7% of children eat fast food three or more times per week; this has not changed since the 2006/2007 NZ Children's Health Survey (Ministry of Health, 2012b). It is well supported by research that a high consumption of takeaway foods in children positively correlates with increased obesity rates and poor health outcomes (Porter, 2019, Donin et al., 2015, Utter et al., 2007).

#### 2.5.6. Chewing and swallowing problems

Biting and chewing skills are not fully developed in preschool children. Preschool children also lack secondary molars which can be used to grind food before swallowing (Byard et al., 1996). These molars do not generally erupt until after 30 months of age (Ministry of Health, 2012a). In addition, behavioural and anatomical differences can impact chewing and swallowing abilities (Ministry of Health, 2012a). It is important that children with chewing and/or swallowing difficulties are identified and directed to an appropriate health professional to assess their swallow as chewing and swallowing problems can increase the risk of choking (Ministry of Health, 2012a) which may also impact nutrition intake.

#### 2.5.7. Fluid intake – water, milk and sugary beverages

Overconsuming beverages can reduce the amount of solid food a preschooler consumes. Preschoolers are recommended to only have sugary beverages occasionally (less than once a week) and to have no more than 500mls of milk per day as overconsumption of milk can displace other foods and nutrients in the diet (Ministry of Health, 2012a). In the GUiNZ study, 13% of the four-year-old children had sugary beverages either daily or several times per week and of the children who were overweight or obese, almost half had a sugary beverage once a week or more (Morton et al., 2017). A high intake of sugary beverages can also increase the risk of dental caries (Thornley et al., 2017).

### 2.5.8. Meal Frequency

Snacking is positively associated with energy intake (Xue et al., 2019). The additional energy intake from snacking may be beneficial for children with low weight however it may increase the risk of overweight and obesity in children at a high weight for height if the snacks are in excess of their daily energy requirements (Xue et al., 2019). The NZMoH recommend young children have three main meals and two to three snacks per day. Continuous grazing is not recommended (Ministry of Health, 2012a). Children have a smaller stomach capacity compared to adults, thus having small and frequent snacks and meals can help children to meet their energy and nutrient requirements (Ministry of Health, 2012a). Studies in Europe have found that family type, income and parental education are associated with meal frequency. Children of single parents, low income families and low educated parents are less likely to meet meal frequency recommendations (of four to six meals per day). This was more pronounced in younger children (seven to 11 years old) compared to older children (11-16 years old) (Parikka et al., 2018, Anne et al., 2015, van Ansem et al., 2014).

Breakfast intake can influence snacking behaviours, the 2002 National Children's Nutrition Survey found children aged five to 14 who ate breakfast were less likely to snack on high calorie foods throughout the day and less likely to be overweight or obese (Ministry of Health, 2003). The majority (84.7%) of NZ children eat breakfast at home especially young children aged two to four (92.3%) (Ministry of Health, 2019a). Those least likely to eat breakfast at home include Māori and Pacific children and those from lower socioeconomic households (Ministry of Health, 2012b).

### 2.5.9. Children choosing how much to eat

The NZMoH recommends that preschool children are given the freedom to choose how much they want to eat (Ministry of Health, 2017b). Not allowing children to self-regulate how much to eat in accordance with their appetite can contribute to weight gain (Scaglioni et al., 2008) and a poor relationship with food in the long term (Brawley and Henk, 2014). In a small study in Sweden on 69 sets of twins, environmental factors such as household environment had a greater influence over development of self-regulatory eating behaviours compared with genetic factors (Faith et al., 2012). Therefore, ensuring the household environment is conducive to encouraging preschool children to regulate their own food intake is important in developing positive eating behaviours.

### 2.5.10. Screen time

The current recommendations for young children are to have less than two hours screen time per day (Ministry of Health, 2012a). Results from the GUiNZ study indicate the average four-year-old watches more than two hours of screen time per day (Morton et al., 2017). In addition to GUiNZ, it is estimated that more than half of NZ children aged zero to 14 years watch more than two hours of television per day (Ministry of Health, 2012b). The Framingham Children Study (2003), a longitudinal study on 106 children, investigated daily television exposure in preschool years (mean age four years) through to early adolescence (mean age 11.1 years) and found children who watched the most television at four years old had the highest percentage of fat mass in adolescence (Proctor et al., 2003).

It is recommended that children do not have a meal in front of the television, as the distraction may impact food choices and food intake (Ministry of Health, 2010). The 2007 NZ Children's Food and Drink Survey reports that 45% of children aged five to seven years old have a meal in front of television (Health Sponsorship Council, 2008). In addition, the National Survey of Children and Young People's Physical Activity and Dietary Behaviours in NZ: 2008/09 reports that 23.6% of children aged five to nine years have their evening meal while watching television at least five times a week (Ministry of Health, 2010). The 2007 NZ Children's Food and Drinks Survey found more than half of children aged five to 16 years had at least some meals in front of television, computer or PlayStation. Children from low, medium and high deprivation areas had a similar rate of exposure to screens during meal times. However, there were differences between ethnicities with Māori children having the lowest rates of screen time during meals (43%) and NZ European children having the highest rates (56%) (Health Sponsorship Council, 2008). There is currently no literature on screen time during meal times in NZ preschool children.

### 2.5.11. Use of supplements in NZ preschool children

The current NZMOH guideline is for children to obtain nutrients from food rather than from supplements (Ministry of Health, 2012a). There is limited data on supplement use in preschool children in NZ. However, the 2002 National Children's Nutrition Survey found less than 5% of five to 14-year olds took a daily supplement, with extremely low rates of dietary supplement use in Māori and Pacific children (Ministry of Health, 2003). An early study on preschool children in the USA found over half (54%) of three-year olds were taking some form of vitamin or mineral supplement, mostly a multi-vitamin complex (Yu et al., 1997). The majority of the

preschool children in this study had mothers who were higher educated, married and with higher household incomes, indicating that sociodemographic factors may be associated with supplement use in preschool children (Yu et al., 1997).

#### 2.5.12. Physical activity

The current recommendations are for young children to have at least 60 minutes of physical activity per day (Ministry of Health, 2012a). Inactivity and sedentary lifestyles are contributing factors to obesity. Creating habitual physical activity and non-sedentary behaviours in preschool years may contribute to the prevention of obesity in later life (Reilly, 2008).

In GUINZ most families (92%) reported their four-year-old child as being physically active one or more times per week (Morton et al., 2017). The National Survey of Children and Young People's Physical Activity and Dietary Behaviours in NZ: 2008/2009 reported that almost all five to nine-year olds in NZ meet the minimum physical activity level of 60 minutes per day (Ministry of Health, 2010). The results in both these studies indicate that most NZ children are meeting the current physical activity recommendations.

#### 2.5.13. Parental perceptions of their child's health

Most NZ parents rate their children in good health. In the New Zealand Health Survey (NZHS) in 2011/2012 98% of children are reported as being "in good health" by their parents and 60% reported their child's health as being excellent (Ministry of Health, 2012b). However, parents are not always aware of their child's health status, Miller et al. (2007) found that fewer than one in four parents correctly recognise their child as overweight. Rysdale (2011) investigated parental perceptions of the NutriSTEP tool and found parents reported that the questionnaire helped them to see the 'whole picture' of their child's eating habits, as well as identify if their preschooler's nutrition was on the right track. This may help parents to positively influence their child's eating behaviours.

### 2.6. The importance of nutrition screening in preschool children

Parents are not always aware of their child's health status and may rely on a health professional to identify any issues (Miller et al., 2007). Using a reliable and validated nutrition screening tool allows the nutrition habits of preschool children to be assessed and nutrition interventions can be directed to those most in need while also being relevant to the prevailing nutrition inadequacies (Randall Simpson et al., 2008). Surveying parents and caregivers to

identify children with poor nutrition behaviours and highest nutrition risk is essential so that children can be referred to appropriate health professionals (Randall Simpson et al., 2008, Skipper et al., 2012). If they are not identified and referred early on, then their first contact with a health professional may not be until their nutrition status has depleted to a point at which they are overweight or obese or experiencing nutrition related illness or nutrient deficiencies (White et al., 2015). Currently in New Zealand when a child turns four years, they are offered a “B4 School Check” with a health professional. The purpose of this check is to identify any health, behaviour or developmental concerns which includes overweight and obesity. Where concerns are identified they are referred to their GP or a child health specialist (Ministry of Health, 2008a).

Some studies have indicated that nutrition and physical activity interventions have limited success at reducing overweight and obesity rates in children (Brown et al., 2019, Flodmark et al., 2006). However, a systematic review of 153 randomised controlled trials found that nutrition and physical activity interventions in the zero to five-year age group may significantly decrease the risk of becoming overweight or obese (Brown et al., 2019). There was the same finding for the six to 18-year-old age group however this was a weak finding with less statistical significance (Brown et al., 2019), indicating that nutrition and physical activity interventions in the two to five-year age group may be more successful than in older age groups.

In Dunedin, NZ the Prevention of Obesity in Infancy (POI) study was implemented to investigate outcomes from additional support and education to parents and caregivers of infants up to 18 months of age (Taylor et al., 2011) with the objective of improving nutrition behaviours and reducing the risk of overweight and obesity in these children. Fangupo et al. (2015) reviewed the success of this programme and found that the intervention had no impact on the infants’ nutrition behaviours.

A limitation to achieving success with interventions in older children is that habits may have already been formed by the age the intervention is implemented (Askie et al., 2010, Fangupo et al., 2015). Due to this, there has been an increase in interest in initiating interventions before obesogenic habits are formed (Fangupo et al., 2015). However, starting interventions too young (before age two) also shows limited success (Fangupo et al., 2015). This indicates nutrition interventions at a young age (younger than 2 years) as well nutrition interventions in older children (six-18 years) have limited success, however, interventions in the two to five-year-old age group show potential to be positive. Findings from B4 school check data between

2010/2011 and 2015/2016 adjusted for sex, ethnicity, urban/rural residence and deprivation showed obesity rates in four-year-old children were declining (Shackleton et al., 2018).

Implementing nutrition interventions in this important life stage (two to five years) may assist to reduce the risk of overweight, obesity and nutrition related disease later in life. However, before interventions can be implemented nutrition screening is essential to identify preschool children at highest nutrition risk and address the most relevant factors.

## 2.7. Nutrition Screening for Every Preschooler (“NutriSTEP”)

This NutriSTEP nutrition screening tool has been developed in Canada and is a valid and reliable tool (Randall Simpson et al., 2008). It can be completed in a five-ten-minute timeframe and is easily understood by parents of young children. The 17 item NutriSTEP includes 6 items on the child’s usual habits including intake of main food groups (grains, dairy, protein, vegetables, fruit, fast food) and 11 items on eating behaviours (screen time, eating difficulties, fluid intake, food security, eating patterns, portion sizes, supplements, growth, weight and physical activity). It is designed to efficiently measure nutrition risk in preschool children both online or in-person and has been found to be valid and reliable in both settings (Carducci et al., 2015, Randall Simpson et al., 2008). The tool has also been adapted for use in the NZ setting (Edge, 2019)

To obtain a total nutrition risk score, responses to the 17 items are scored between zero to four and are summed to give a total nutrition risk score (maximum of 68). **Table 2.1** provides cut off points for each risk category (Belsito et al., June 2015).

**Table 2.1: NutriSTEP Nutrition Risk Categories**

Score	Risk
≤20	No/low risk
21-25	Moderate risk
26-30	High risk

A review of the first four months of screening using NutriSTEP in 4,000 Canadian preschool children (aged three to five) found low nutrition risk ranged from 55-75% (Belsito et al., June 2015, Randall Simpson et al., 2008, Randall Simpson et al., 2015). **Table 2.2** shows the expected rates of each nutrition risk category based on research and implementation of the NutriSTEP tool in Canada.

**Table 2.2. Expected rates of nutrition risk based on Canadian population (Belsito et al., June 2015)**

Risk category	Expected rates (%)
No/low	55-75
Moderate	11-30
High	10-17

In a three-year evaluation of the Nutri e-STEP (an online version of NutriSTEP) on 8051 preschoolers, the children had a mean nutrition risk score of  $20 \pm 8$  and a total of 30% were at moderate to high nutrition risk (Randall Simpson J, 2018).

**Table 2.3. Key findings from three-year Nutri e-STEP evaluation on Canadian preschoolers (n=8051)**

Item	Findings
Grains	55% had low intake frequency
Meat and Alternates	40% had low intake frequency
Fruit and Vegetables	33% had low intake frequency
Screen time	65% had 2+ hours per day

A further study using the NutriSTEP in Canada to assess nutrition risk in 364 preschool children and the parents' perceptions of their child's nutrition habits found that 81% of the children were at low nutrition risk and 19% were at moderate to high nutrition risk (Rysdale et al., 2011).

As far as we are aware, the only other study in NZ using NutriSTEP was the reliability study which adapted NutriSTEP for use in NZ preschoolers. This was a small study of 79 preschool children in Auckland which found 31.6% were at moderate to high nutrition risk. The most prevalent areas of nutritional concern were low intakes of grains, meat and meat alternatives, milk and milk products, vegetables and a lack of choice over the amount of food consumed. (Edge, 2019). Parents of preschoolers in this study were almost all female, tertiary educated, identified as NZ European, with English as a first language. Preschoolers were recruited from childcare centres in a diverse range of locations in Auckland. Most of the children were aged three or four, half were female and most were NZ/European.

## 2.8. Summary

This narrative review describes nutrition risk in preschool children in NZ and overseas. It explores key areas where preschool children are not meeting nutrition recommendations along with sociodemographic characteristics associated with nutrition risk. Poor nutrition habits can develop early in life, persist into adulthood and, increase the risk of overweight, obesity and nutrition related disease. It is possible for poor nutrition habits to be overlooked and intervention only takes place once markers for poor nutrition are identified by health professionals. Using a valid and reliable screening tool allows for preschool children at highest nutrition risk to be identified before poor health outcomes are present. Previous research indicates sociodemographic disparities are apparent with Māori, Pacific and Asian children having lower intakes of fruit and vegetables and Māori and Pacific children and those living in areas of highest deprivation having the highest rates of nutrition related disease. This study aims to explore the nutrition risk status of preschool children and associated sociodemographic factors.

## **CONFLICTS OF INTEREST**

None



### 3. Chapter 3: Research Study Manuscript

#### 3.1. Abstract

**Aim:** To determine the prevalence of nutrition risk using the validated, Nutrition Screening Tool for Every Preschooler (NutriSTEP) among preschool children in New Zealand (NZ) and to identify sociodemographic factors associated with nutrition risk.

**Methods:** Parents/caregivers of NZ preschool children (aged two to five years) completed an online survey including NutriSTEP, parent and child height, weight and sociodemographic characteristics. The 17-item NutriSTEP responses were scored between zero and four; item scores  $\geq 2$  indicate risk, maximum score is 68. Participants were stratified into; low risk (NutriSTEP score  $\leq 20$ ) and moderate to high risk (NutriSTEP score  $> 20$ ) groups and associations between nutrition risk and sociodemographic characteristics were explored using a Pearson chi-squared test and binary regression.

**Results:** Of 505 preschool children, 96 (19%) were at moderate to high risk (median IQR NutriSTEP score 24 [22,26]) and 409 (81%) were at low risk (median IQR NutriSTEP score 13 [10,16]). Preschool children at highest risk were non-NZ European ( $p=0.002$ ), with solo parents ( $p=0.002$ ), from households with incomes  $\leq \$50,000$  ( $p \leq 0.021$ ) and with non-university educated parents ( $p \leq 0.0001$ ). Of the NutriSTEP items  $> 30\%$  of preschoolers were at high risk for inadequate consumption of fruit, vegetables, grains, milk products, meat and meat alternatives as well as exposure to screens during meals and overuse of supplements.

**Conclusion:** A fifth of NZ preschool children were at moderate to high nutrition risk, and may not have met their health and nutrition guidelines. Economic and ethnic disparities were apparent indicating social inequity increases nutrition risk in NZ preschool children. The most prevalent nutrition risk factors were inadequate intakes of all the major food groups, excessive screen-watching during meals and overuse of supplements. Using NutriSTEP may assist to identify NZ preschool children at highest nutrition risk who may benefit from appropriate nutrition support.

### 3.2. Introduction

Inadequate nutrition during early childhood is associated with a range of adverse health outcomes including, overweight, obesity and nutrition related disease (Daniels, 2009, Morton et al., 2017, Krushnapriya et al., 2015, Gerritsen et al., 2018).

Nutrition risk is defined as “the presence of characteristics or risk factors that can lead to impaired nutritional status” (American Dietetic Association, 1994). Children at high nutrition risk are more likely to experience impaired growth and development (Hoffman and Klein, 2012), reduced cognitive function, impaired social development (Liu and Raine, 2017), poor oral health (Çolak et al., 2013), weight gain (Morton et al., 2017), poor sleeping patterns (Chaput et al., 2018) and reduced educational attainment (Feinstein et al., 2008). Sedentary behaviours and inadequate physical activity may also contribute to weight gain (Morton et al., 2017), impair development of motor skills (van Beurden et al., 2008) and reduce bone density (Specker et al., 2015). Poorly acquired nutrition habits in childhood may lead to an increased risk of nutrition-related preventable diseases in later life such as ischaemic heart disease, type 2 diabetes and colon cancer (Daniels, 2009). While modifiable, these chronic diseases may have an adverse effect on quality of life. Identifying preschool children with poor nutrition habits early on may help to lower the risk of developing these diseases later in life.

Nutrition screening, is a process to identify an individual who is malnourished or who is at risk for malnutrition to determine if a detailed nutrition assessment is indicated (American Society for Parenteral and Enteral Nutrition, 2010, p.283) and provides an opportunity to assess nutrition, physical activity and sedentary behaviours. Some of these behaviours may be present long before a low or high BMI or nutrient deficiencies are identified by health professionals. For preschool children between ages of two and five years, body mass index (BMI) can help provide an indication of whether their growth rate is within the expected range (World Health Organization, 2020).

The NutriSTEP (“Nutrition Screening Tool for Every Preschooler”) questionnaire is a parent administered nutrition screening tool developed in Canada to identify preschool children at nutrition risk and includes assessment of food intake, growth and development, physical activity, sedentary behaviours, food security and the feeding environment (Belsito et al., June 2015). Previous studies using the NutriSTEP tool suggest the estimated prevalence of moderate to high nutrition risk ranges from 19 to 45% in early childhood (Belsito et al., June

2015, Randall Simpson et al., 2008, Randall Simpson et al., 2015, Randall Simpson J, 2018, Rysdale et al., 2011).

In NZ children, poor oral health and obesity are the most prevalent nutrition-related health conditions with the highest rates among indigenous Māori and Pacific children and those living in low socioeconomic households (Ministry of Health, 2012b, Gerritsen et al., 2018). Growing Up in NZ (GUiNZ), a longitudinal study of over 6,000 children from birth to early adulthood, explored a cross-section of 1141 preschool children aged 45 months at home and in early childhood centres and found only 4% complied with recommended nutrition behaviours such as eating breakfast at home and, a variety of foods in addition to positive parental role modelling of healthy eating habits, eating together as a family and without watching screens (Gerritsen et al., 2018). The low rate of compliance to recommended nutrition behaviours in these preschool children indicates there is a need for nutrition screening in NZ which would allow the opportunity to provide interventions to those at increased nutrition risk.

Identifying characteristics or risk factors before school entry may be an effective way of identifying preschool children who require preventive dietary intervention. If preschool children at increased nutrition risk are not identified poor nutrition habits can persist into adulthood and may lead to overweight, obesity and nutrition related disease. Therefore, the purpose of this study was to establish the prevalence of nutrition risk and to identify sociodemographic factors associated with high to moderate nutrition risk among NZ preschool children.

### 3.3. Materials and Methods

#### Study design

An observational study design, was used to investigate and describe the prevalence of nutrition risk among preschoolers. We conducted a cross sectional online survey using convenience sampling.

#### Subjects

Eligible parents and caregivers of preschool aged children were recruited who had child aged between two and five years, had resided in NZ for at least five years, and were English

speaking. The minimum sample size was calculated to be 384 participants to detect an effect with a confidence interval of 95%  $\pm$ 5% margin of error.

### Ethics

This study was approved provided by the Massey University Human Ethics Committee: (Northern), Reference No.19/30 and all participants provided informed consent.

#### 3.3.1. The Online Survey

Sociodemographic data was obtained from a 28-item questionnaire. The child and parent/caregiver's age, weight, height and ethnicity; and household size, income and composition; and parental occupation and education level were established. Annual household income (gross) was categorised as " $\leq$ \$50,000" or " $>$ \$50,000", household composition as "single parent" or "two parent household", occupation as "employed" or "not employed" and education as "university educated" or "not university educated".

Geographical location was identified from the parental address and was categorised as North or South Island. The NZ deprivation (NZDep) index was obtained from the NZ Ministry of Health and was used as an indication of socioeconomic deprivation. The index was constructed from geo-coded addresses and included eight dimensions of material and social deprivation reflecting lack of income, employment, communication, transport, support, educational qualifications, home ownership and living space. (Atkinson, 2014).

Parent/caregiver and child BMI was calculated using  $\text{weight(kg)/height(m}^2\text{)}$  (World Health Organization, 2020) using self-reported weight and height.

The child healthy BMI range was determined from the 5<sup>th</sup> to  $<$  85<sup>th</sup> percentile for weight and height based on age and gender (**Table 3.1**) (World Health Organization, 2020).

**Table 3.1. Healthy BMI ranges for girls and boys aged two to five years (World Health Organization, 2020)**

Girls		Boys	
Age (years)	Healthy BMI Range (kg/m <sup>2</sup> )	Age (years)	Healthy BMI range(kg/m <sup>2</sup> )
2	14-18	2	14.4-18.1
3	13.8-17.2	3	14-17.3
4	13.4-16.8	4	14-17.25
5	13.6-17	5	13.75-17.8

Nutrition risk was determined using the 17-item Nutrition Screening Tool for Every Preschooler (NutriSTEP) (Belsito et al., June 2015). NutriSTEP is a valid and reliable tool that has been adapted for use in NZ preschoolers (Edge, 2019) and validated for both online and in-person usage (Carducci et al., 2015, Randall Simpson et al., 2008). NutriSTEP provides information on food intake (including all main food groups, fast food consumption and eating patterns) and risk factors for food intake (screen time, eating difficulties, food costs, supplements and physical activity). NutriSTEP items were scored between zero and four and summed with a total score ranging between zero to 68.

The sample was first stratified into three groups (low, moderate and high nutrition risk); due to the low number of children at increased nutrition risk, the moderate to high risk groups were combined to provide power for the statistical analysis. Therefore, the sample was categorised into two groups; “low risk” (NutriSTEP score  $\leq 20$ ) and “moderate to high risk” (NutriSTEP score  $> 20$ ).

High risk responses (score  $\geq 2$ ) to individual NutriSTEP items were identified. An item was categorised as a high risk if more than 30% of participants had responded with a high-risk response (score  $\geq 2$ ) (Randall Simpson et al., 2008). This indicated nutrition, health or physical activity guidelines were not met.

### 3.3.2. Data Collection

A convenience sampling method was used to reach eligible parents through 24 childcare centres and child-focussed organisations such as playgroups. An advertisement was placed on noticeboards and distributed on social media through Facebook to invite parents and caregivers to participate in the study. Facebook advertisements targeted individuals aged between 19 and 45 years and had a reach of 36,952 views from which 2780 individuals engaged with the advertisement. Parents who engaged were invited to read an information sheet hosted in Google Forms (**Appendix B4**) and, if they met the inclusion criteria and chose to participate, an online consent also hosted in Google Forms was completed (**Appendix B5**). Following consent eligible parents and caregivers were emailed a unique non-identifiable code to access and complete the online survey hosted in Google Forms which took approximately ten minutes to complete.

### 3.3.3. Statistical analysis

Data was screened to remove any incomplete data. Normality was tested using Kolmogorov-Smirnov, Shapiro-Wilk tests and the histogram, box plot, de-trended plot and Q-Q normality plot. Levene's test of homogeneity was also conducted. Parametric data was reported as mean $\pm$ SD. Non-parametric data was log transformed and if not normally distributed ( $p < 0.05$ ) was reported as untransformed median [interquartile range].

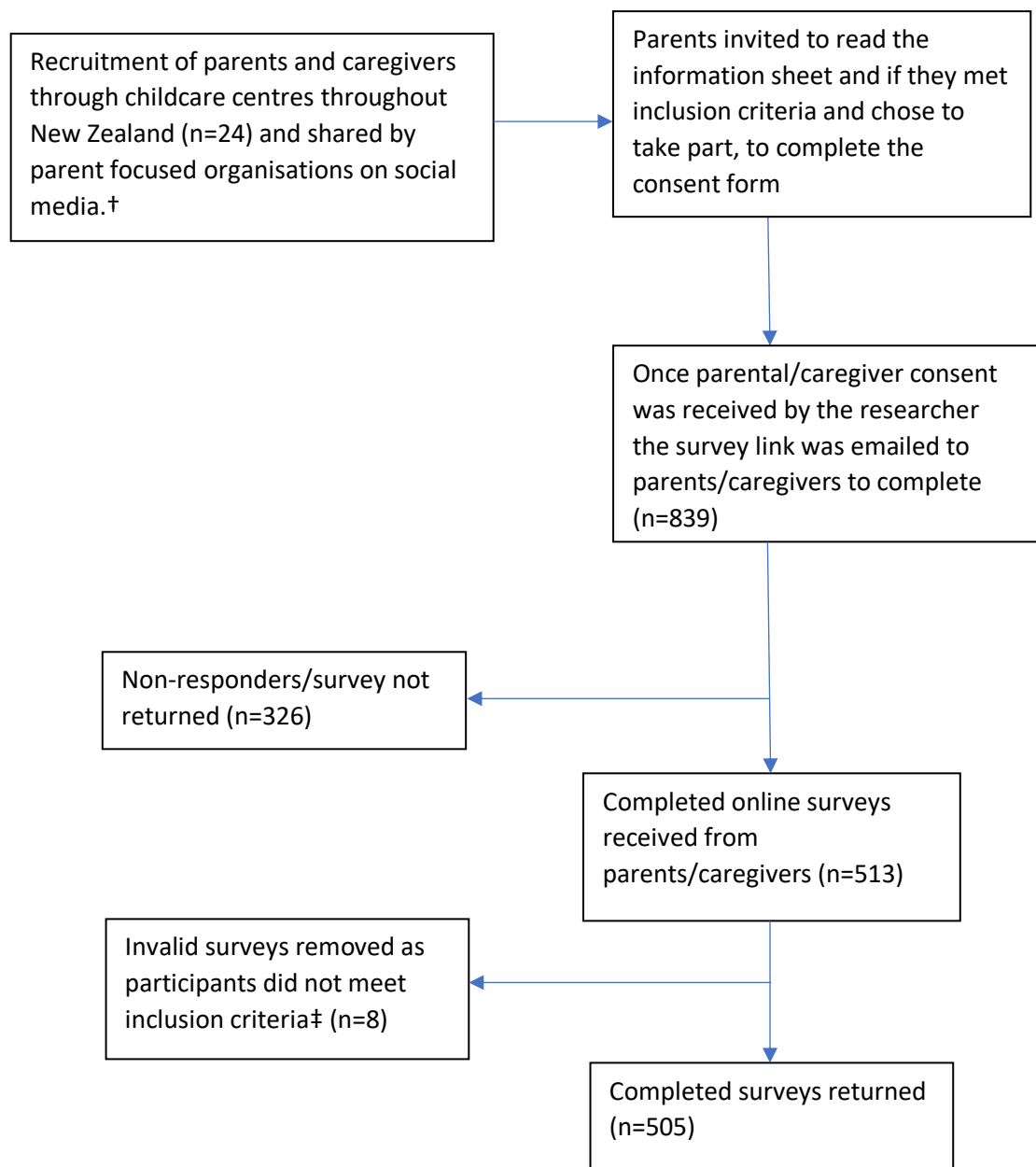
Descriptive analyses were completed for socio-demographic and parental and child physical characteristics (gender, weight, BMI, ethnicity, age, household composition, educational level, region of residence and deprivation index). Pearson chi-square test for independence was performed to examine associations between low risk and moderate to high risk groups for sociodemographic, parental and child characteristics. Differences were considered significant if  $p \leq 0.05$ .

Binary regression analysis was used to investigate the strength of positive associations and establish an odds ratio for sociodemographic factors significantly associated with nutrition risk.

Statistical analyses were performed with SPSS version 24 (IBM Corp. Released 2016. IBM SPSS Statistics for Windows, Version 24).

### 3.4. Results

Of the 839 parents/caregivers who consented to take part in the study and were emailed the online survey, 505 completed surveys were returned for inclusion in the study (**Figure 3.1**). **Table 3.2** provides the child, parent and household characteristics.



**Figure 3.1. Flowchart for the recruitment of the participants**

†Parent focussed organisations include media outlets and businesses providing parenting information. Childcare centres include kindergartens, preschools, early child care centres and playgroups.

‡All participants were provided with the inclusion criteria in the information sheet with the consent form. However, eight participants incorrectly consented to take part and returned the survey which identified they did not meet the inclusion criteria. These surveys were invalid and removed.

**Table 3.2 Child, parent and household characteristics**

Participant characteristics			n (%)	
Total Participants			505 (100)	
Parent Gender				
Female			502 (99.4)	
Male			3 (0.6)	
Child Gender				
Male			251 (49.7)	
Female			254 (50.3)	
Household Income (per annum) <sup>†</sup>				
≤\$30,000			16 (3.2)	
>\$30,000-≤\$50,000			35 (6.9)	
>\$50,000-≤\$70,000			78 (15.4)	
>\$70,000-≤\$100,000			123 (24.4)	
\$100,000-≤150,000			128 (25.3)	
\$150,000+			82 (16.2)	
Child age (years)				
2			168 (33.3)	
3			225 (44.5)	
4			93 (18.5)	
5			19 (3.8)	
			Mean±SD	Range
Household Size			4.2±1	2-8
Parent/caregiver Age (years)			35.2±4.5	22.2-54.1
Parent/caregiver BMI (kg/m <sup>2</sup> )§			25.7 ±4.9	17.26-45.2
Child Age (months)			42.6 ±11.1	24-71
Child BMI (kg/m <sup>2</sup> )‡	Age	N (%)	Mean±SD	Range
All children		283	16±3.2	8.4-29.1
Girls	2	32	12.7±2	8.4-17
	3	61	15±1.8	11-19
	4	43	17.8±3.1	14.5-29
	5	12	18.6±2.6	10.8-19
	Girls Total		15.6±3.2	8.4-29
Boys	2	41	13.8±2	10.8-19
	3	44	15.6±2.1	11-22
	4	30	18±2	14-22
	5	19	19±4.4	12-29.1
	Boys Total		16.4±3.2	10.8-29.1
Nutrition Risk Score	n (%)	Median [25th,75th]	Mean±SD	Range
Total	505	14 [11,19]	15.4±5.7	5-35
Low (≤20)	409(81)	13[10,16]	13.33±3.8	5-20
Moderate (21-25)	68(13.5)	22[21,24]	22.6±1.5	21-25
High (>25)	28(5.5)	29[27,30]	28.8±2.2	26-35

SD, standard deviation; <sup>†</sup>Percentages may not add up to 100% due to the analysis excluding missing data

<sup>‡</sup>Child BMI: the healthy BMI range for 2-5 years: Girls - 13.6-18kg/m<sup>2</sup>, Boys - 13.75-18.1 kg/m<sup>2</sup> and (World Health Organization, 2020)  
<sup>§</sup>Adult BMI: <18.5kg/m<sup>2</sup> = underweight, 18.5-24.9kg/m<sup>2</sup> = healthy weight, 25-29.9kg/m<sup>2</sup> = overweight, ≥30kg/m<sup>2</sup> = obese (World Health Organization, 2020)



### 3.4.1. Nutrition risk factors

High risk responses (score  $\geq 2$ ) to individual NutriSTEP items are provided in **Table 3.3**. Scoring for NutriSTEP items is provided in **Appendix B6**. Of the 505 participants, one-third to two-thirds of preschool children had high risk responses for intake of grains, milk products, fruit, vegetables, meat or meat alternatives, supplement use and exposure to screens during meals and are shaded in **Table 3.3**.

NutriSTEP items where high risk responses applied to less than 10% of participants were parental perception of their child's weight or growth, daily screen time, physical activity levels and chewing or swallowing problems. This indicates more than 90% of preschool children were meeting the guidelines for these NutriSTEP items.

**Table 3.3 High risk responses for NutriSTEP items**

NutriSTEP item	Recommendation	Higher risk response (NutriSTEP score $\geq 2$ )	Participants with higher risk scores n(%)
Grain products	4 servings per day <sup>†</sup>	$\leq 3$ x per day	305(60.4)
Milk products	2+ servings per day <sup>†</sup>	$\leq 2$ x per day	247(48.9)
Takes supplements	Nutrients should be obtained from food <sup>†</sup>	Sometimes – always	223(44.2)
Fruit	2+ servings per day <sup>†</sup>	$\leq 2$ x per day	206(40.8)
Meat or alternatives	1-2+ serves per day <sup>†</sup>	$\leq 1$ x per day	192(38)
Eats while watching TV or other digital devices	Never <sup>§</sup>	Sometimes – always	189(37.4)
Vegetables	2+ servings per day <sup>†</sup>	$\leq 1$ x per day	165(32.7)
Fast food	$< 1$ x per week <sup>‡</sup>	$\geq 1$ x per week	141(27.9)
Difficulty buying food	N/A	Sometimes to most of the time	132(26.1)
Usually eats (no. of meals per day)	3 main meals plus snacks <sup>‡</sup>	$\leq 2$ or $> 5$ x per day	97(19.2)
Not hungry at mealtimes due to drinking all day	Water and milk between meals. Up to 2 cups of milk per day <sup>‡</sup>	Sometimes to most of the time	90(17.8)
Child decides how much to eat	Always <sup>‡</sup>	Sometimes to never	83(16.4)
Physical Activity	1+ hours per day energetic play (2-4 years). 1+ hours moderate to vigorous activity (5+ years) <sup>‡</sup>	Needs more physical activity	38(7.5)
Weight <sup>¶</sup>	N/A	Should weigh more or should weigh less	37(7.3)

Watches TV, computer/other devices, and plays video games	<1 hour per day (2-4 years) <2 hours per day 5 years‡	≥3 hours per day	33(6.5)
Chewing, swallowing, gagging or choking when eating	N/A	Sometimes or most of the time	32(6.3)
Growth adequate¶	N/A	No	9(1.8)

†Ministry of Health (2012a)

‡Ministry of Health (2017b)

§Ministry of Health (2010)

¶Based on parent's perception of child's growth/weight

Socio-demographic characteristics associated with nutrition risk in preschool children are provided in **Table 3.4**.

Of the 96 (19%) preschool children at moderate to high nutrition risk, nutrition risk was associated with ethnicity and household composition, with an increase in nutrition risk evident in non-NZ European preschool children ( $p=0.002$ ) and preschool children from a single parent household ( $p=0.002$ ). Nutrition risk was inversely associated with education and income, with an increase in nutrition risk evident in preschool children with a non-university educated parent ( $p<0.001$ ) and from households with an annual income below \$50,000 ( $p<0.021$ ). Two thirds 67 (69.8%) of preschool children were at moderate to high nutrition risk from households where income was >\$50,000 indicative of the importance of factors other than household income in relation to nutrition risk.

**Table 3.4. Socio-demographic characteristics associated with nutrition risk in preschool children**

Socio-demographic characteristics	NutriSTEP Scores		Total n (%) 505 (100)	Low risk (≤20) n (%) 409 (81)	Moderate/ High risk (>20) n (%) 96 (19)	X <sup>2</sup>	df	P-value*	OR (95% CI)
	median [25 <sup>th</sup> ,75 <sup>th</sup> ]	mean ±SD							
Household Composition						9.646	1	0.002	2.84(1.44, 5.63)
Two parent/caregiver family	14 [11,19]	15±6	465 (92.1)	384 (93.9)	81 (84.4)				
Solo parent/caregiver	19 [13,21]	18±6	40 (7.9)	25 (6.1)	15 (15.6)				
Household Income (per annum)						5.342	1	0.021	2.14(1.12,4.13)
≤\$50,000	18 [13,21]	18±6	51 (10.1)	36 (8.8)	15 (15.6)				
>\$50,000	16 [12,20]	17±6	411 (81.4)	344 (84.1)	67 (69.8)				
Prefer not to answer/Don't know			43 (8.5)	29 (7.1)	14 (14.6)				
Region						0.156	1	0.69	
North Island	14 [11,19]	15±6	340 (67.3)	277 (67.7)	63 (65.6)				
South Island	14 [12,20]	16±5	165 (32.7)	132 (32.3)	33 (34.4)				
NZ Deprivation Index (NZDep2013)						1.686	2	0.43	
1-3 (least deprived)	14 [11,18]	15±5	148 (33.3)	122 (29.8)	26 (30.6)				
4-6	14 [12,19]	15±5	145 (32.6)	120 (29.3)	25 (29.4)				
7-10 (most deprived)	16 [11,20]	16±6	151 (34.2)	117 (28.6)	34 (40)				
Parent Ethnicity						3.337	1	0.07	
NZ European	14 [11,19]	15±6	407 (80.6)	336 (82.2)	71 (74)				
All other ethnicities†	15 [11,21]	16±6	98 (19.4)	73 (17.8)	25 (26)				
Parent Highest education level						12.348	1	<0.0001	2.32(1.44, 3.74)
University or other tertiary education	14 [11,18]	15±6	385 (76.2)	325 (79.5)	60 (62.5)				
Non-university educated	18 [13,22]	18±6	120 (23.8)	84 (20.5)	36 (37.5)				
Parent Occupation						0.206	1	0.65	
In Paid Work	14 [11,19]	15±6	391 (77.4)	315 (77)	76 (79.2)				
Not in paid work	15 [12,19]	16±6	114 (22.6)	94 (23)	20 (20.8)				
Child Ethnicity						9.591	1	0.002	2.41(1.36, 4.24)
NZ European	14 [11,19]	15±6	438 (86.7)	364 (89)	74 (77.1)				
All other ethnicities‡	18 [12,22]	17±6	67 (13.3)	45 (11)	22 (22.9)				

Significant differences between the low and moderate/high risk groups were determined by Pearson Chi-Square test (X<sup>2</sup>)

\*Difference statistically significant when p<0.05

df = degrees of freedom, OR = Odds Ratio, CI = Confidence Interval

†The parent/caregivers from "other/non-NZ European ethnicities" (19.4%) included 8.9% European, 4.2% Asian, 3.8% NZ Māori, 0.8% American, 0.6% South African, 0.4% Pacific people, 0.4% Australian, 0.2% New Zealander and 0.2% Tau iwi.

‡The preschool children of "other/non-NZ European ethnicities" (13.3%) included 6.3% NZ Māori, 3.2% Asian, 1.6% European, 0.6% Pacific people, 0.4% Tau iwi, 0.2% American and the remaining 1% were of mixed ethnicity.

Using binary regression analysis, it was found that non-NZ European preschool children were 2.4 times more likely to be at moderate to high nutrition risk compared to NZ European preschool children (OR 2.405 (95%CI 1.36, 4.24)). Preschool children with a non-university educated parent were 2.3 times more likely to be at moderate to high nutrition risk (OR 2.321 (95%CI 1.44, 3.743)). Preschool children living in single parent families were 2.8 times more likely to be at moderate to high nutrition risk compared to those who lived with two parents (OR 2.844 (95%CI 1.44, 5.63)). Preschool children from households with incomes below ≤\$50,000 were 2.1 times more likely to be at moderate to high nutrition risk compared to those from higher income households (OR 2.14 (95%CI 1.12, 4.13)).

### 3.5. Discussion

Overall, we found a fifth (19%) of preschoolers were at moderate to high nutrition risk, similar to an investigation in Canada among 364 preschool children aged three to five where 19% were also at moderate to high nutrition risk (Rysdale et al., 2011). The Canadian preschoolers were also predominantly from two parent, higher income (>CAD\$60,000 per annum) households with university educated mothers. In NZ, among a small sample (79) of preschoolers involved in the reliability testing of the adapted NZ NutriSTEP tool, a third (32%) were at moderate to high nutrition risk (Edge, 2019). Although these preschool children were mostly from highly educated parents, they were recruited from one urban centre where the cost of living and other lifestyle factors differ from other regions in NZ.

In the current study, preschool children were 2.4 times more likely to be at moderate to high nutrition risk who were non-NZ European versus NZ European (OR 2.405, 95%CI: 1.36-4.24). Data on dietary intake among ethnically diverse preschool children is limited, however the NZ Health Survey 20018/2019 reported 71.7% of Pacific and 71.4% of Asian children aged two to 14 years did not meet the recommended serves of fruit and vegetables per day compared with 48.7% of NZ European children (Ministry of Health, 2019a). Additionally, 14.4% of Māori and 18.8% of Pacific children had fizzy drinks at least three times per week compared to 7.7% of NZ European children, and 12.1% of Māori children and 17.8% of Pacific children had fast food three or more times per week versus 3.9% of NZ European children (Ministry of Health, 2019a). Previously overweight and obesity was reported to be higher in non-NZ European preschool children (19%) versus NZ European preschoolers (9%) (Morton et al., 2017) which may reflect poorer eating habits and a higher intake of energy dense foods.

We found preschool children of non-university educated parents were 2.3 times more likely to be at nutrition risk (OR 2.321, 95%CI 1.44-3.743). In the United Kingdom, parental education was found to be inversely associated with nutrition risk, where 9550 four-year olds with lower educated mothers were significantly more likely to have a frequent intake of high fat, high sugar, convenience and processed foods compared to those with highly educated mothers (Northstone and Emmett, 2005). In NZ, parents who were university educated may have higher incomes (Stats NZ, 2019a), and therefore more likely to afford healthier foods and have the knowledge to prepare healthy foods to meet their child's needs.

In this study, preschool children from single versus two parent households were at 2.8 times more likely to be at higher nutrition risk (OR2.844, 95%CI 1.44-5.63). Similarly, a study in the United States found preschool children from single parent families were more likely to have poorer nutrition habits including a higher intake of energy and fat, less likely to meet fruit and vegetable recommendations and more likely to drink fizzy drinks compared to two parent households (Bowman and Harris, 2003). Single parent families may face different pressures compared to two parent families such as reliance on one income, additional childcare costs and balancing family and work commitments which may have an adverse effect on the preparation of healthy meals. In NZ 38% of single parents families have been found to be food insecure compared to 12.7% of two parent families (Ministry of Health, 2019b) and this may have been an underlying factor in the current study especially as NZ female solo parents are two times more likely to be food insecure compared to male solo parents (Carter et al., 2010).

Preschool children from households with incomes  $\leq$ \$50,000 in this study were 2.1 times more likely to be at nutrition risk, compared to those with incomes above \$50,000 (OR2.14, 95%CI: 1.1-4.126) which is below the median (gross) annual household income of \$80,354 for NZ households (Stats NZ, 2019b). A 60% threshold of the national median income (\$48,212) is used as an indicator of those experiencing greatest poverty (Ministry of Social Development, 2019) which suggests households with incomes less than \$50,000 in the current study may be experiencing financial hardship. Additionally, a third (27.9%) of parents in this study reported they had difficulties buying food due to cost. Children who live in low-income households are more likely to have poor nutrition, including low intakes of fruit and vegetables, higher intakes of fast food and sugary beverages and be less physically active (Ministry of Health, 2019b, Smith et al., 2013, Parnell and Gray, 2014, Carter et al., 2010).

We found food group items with high risk responses (score  $\geq$ 2) were a low daily intake of grains (60.4%), milk products (48.9%), fruit (40.8%), meat and meat alternatives (38%) and

vegetables (32.7%). Previously, among 550 NZ European preschool children only 7% consumed the recommended  $\geq 4$  serves of grains per day and 27% consumed less than two serves of fruit and vegetables a day (Theodore et al., 2009). Grains, fruit and vegetables are all important sources of carbohydrate for preschool children, and key sources of dietary fibre for digestive health and fruit and vegetables provide an essential source of vitamins, minerals and antioxidants (Ministry of Health, 2012a). We found almost half (48.9%) of the preschool children had less than two serves of milk or milk products per day below the recommended two to three serves a day (Ministry of Health, 2012a). This low intake of milk products indicates that almost half of the preschoolers may be at risk of not meeting daily calcium requirements and do not benefit from the energy, protein and other nutrients provided by milk (Ministry of Health, 2012a). The current study also found over a third (38%) of preschool children consumed meat and meat alternatives once or less per day, below the recommendation of at least one to two serves per day (Ministry of Health, 2012a). As these foods are an essential source of iron, preschool children may be at higher risk of iron deficiency which can negatively impact cognitive function, learning ability and social behaviour (Grant et al., 2007; Liu & Raine, 2017). Additionally, meat, grains and dairy products are key sources of protein essential for attaining optimal growth and development (Ministry of Health, 2012a). More than 30% of preschool children had an inadequate intake of all the main food groups and this may increase their risk of nutrient deficiencies, adversely impact growth and development and increase the risk of obesity and nutrition related disease later in life.

Over one-third of the preschool children watched screens during mealtimes. Previously the National Survey of Children and Young People's Physical Activity and Dietary Behaviours in NZ reported 24% of children aged five to nine years watched television during meal times at least five times a week (Ministry of Health, 2010). As this survey was conducted over ten years ago the frequency of television watching may have increased which is a concern as this practice can cause children to become distracted and under or over-eat.

We observed that almost half (44%) of the preschool children used supplements contrary to recommendations that children two to 14 years obtain nutrients from food versus supplements (Ministry of Health, 2012a). Data from the 2002 National Children's Nutrition Survey reported less than 5% of five to-14-year olds took a daily supplement (Ministry of Health, 2003) and our results suggest that usage may have increased since this time. Preschoolers may be prone to fussy eating and irregular eating patterns (Benton, 2004), and parents of young children may be enticed to use supplements as a result of messages from

health professionals, organisations and media reiterating the importance of meeting nutrient requirements. Among 8285 US preschool children where a half (54%) took a regular supplement the highest rates of usage were among two person households with higher incomes and of mothers with a higher education (Yu, Kogan, & Gergen, 1997). These demographic features are similar to households in the current study and indicate affordability among highly educated mothers may be associated with higher rates of supplement use in preschool children.

Overall, these findings suggest the NutriSTEP tool provides a simple index for nutrition screening in the preschool population. NutriSTEP can increase food and nutrition awareness among parents and caregivers as well as health and education providers. As the NutriSTEP tool can be self-administered by parents there is the potential for universal access especially where accompanied by downloadable resources and websites focusing on healthy eating practices for this age group. NutriSTEP provides the feasibility for use in a variety of settings to identify those preschoolers at highest risk for whom appropriate interventions can be recommended.

In NZ, 83% of three years olds and 89% of four-year olds attend childcare facilities including kindergartens, preschools and early childcare centres (Stats NZ, 2017). Use of NutriSTEP in these settings may offer insight into the range of community-level nutrition issues such as identified in the current study. Nutrition interventions in preschool children have been found to be most successful when they are multi-factorial and include a family-based approach and supported by public health policies (Black, D’Onise, McDermott, Vally, & O’Dea, 2017). Tackling nutrition issues within childcare centres that include a family-based approach may provide parents with the abilities and skills to improve nutrition, physical activity and sedentary behaviours. Successful nutrition interventions in preschool children have included edible gardens, teacher modelling of healthy eating, individual or group nutrition education, practical nutrition and/or physical activity sessions including meal preparation with preschool children and parents (Black et al., 2017).

Nutrition screening through medical centres and parent and child health organisations such as Plunket may also be feasible to identify preschool children at highest nutrition risk, where individual nutrition counselling could be provided. This would allow for preschool children who do not attend childcare, kindergarten or preschool to also receive appropriate nutrition support.

The utility of the validated NutriSTEP tool was a strength of this study to identify preschool children at highest nutrition risk. There were several limitations in this study. Parental participation was self-selected through convenience sampling and a high proportion of NZ European preschool children, higher educated two parent households with middle to high incomes were represented. As weight and height of the parents and preschool children were self-reported it was not possible to obtain an accurate body mass index for all of the parents and preschool children. Additionally, the parents were proxy reporters for their child this may have increased the risk parent/caregiver bias.

In conclusion, this study identified almost a fifth of preschool children were at increased nutrition risk and may not have met the health and nutrition guidelines for this age group. Ethnic and economic disparities were apparent with higher nutrition risk amongst preschool children who were non-NZ European, of solo parents, from lower income households and non-university educated parents. The prevalence of these sociodemographic factors amongst preschool children at highest nutrition risk indicates social inequity which tends to be more prevalent amongst lower sociodemographic populations (Howden-Chapman and Tobias, 2000, Ministry of Health, 2002). Additionally, we found that preschool children had low intakes of all the major food groups, an excessive exposure to screens during meals and supplements were unnecessarily overused. The use of NutriSTEP may assist to identify preschool children at highest nutrition risk who may benefit from appropriate nutrition support.



## 4. Chapter 4: Conclusions and Recommendations

This study aimed to explore the prevalence of nutrition risk in NZ preschool children (two to five years) and factors associated with nutrition risk. The objectives were to identify preschool children at low, moderate and high nutrition risk using the NZ-tested validated NutriSTEP tool, to identify key areas of nutritional concern and socio-demographic associations in preschool children who were at highest nutrition risk. Investigating these factors may assist with identifying characteristics of preschool children at highest nutrition risk and who may benefit from further assessment and intervention.

The main findings in relation to each of the objectives are presented below:

*Objective 1: To identify the prevalence of nutrition risk among preschool children (aged two to five) using a valid and reliable screening tool “Nutrition Screening Tool for Every Preschooler” (NutriSTEP)*

The prevalence of nutrition risk was established based on the NutriSTEP scores and preschool children were categorised as low, moderate or high-risk using cut-points  $\leq 20$  = low risk, 21-25 = moderate risk and  $> 25$  = high risk. Almost one-fifth of the NZ preschool children aged two to five were at moderate to high nutrition risk indicating they had poor nutrition habits and may not meet nutrition and physical activity guidelines. This was similar to two studies using NutriSTEP among Canadian preschool children (Rysdale et al., 2011, Watterworth et al., 2017). However, it is lower than the NZ study that adapted and tested the reliability of the NutriSTEP for the NZ population, which was conducted on Auckland preschool children (Edge, 2019). The differences in the prevalence of nutrition risk among the studies on NZ preschool children may be related to differences in sociodemographic characteristics of the sample. Although the preschool children in NZ reliability testing of NutriSTEP were mostly from highly educated parents, similar to the current study, they were recruited from one urban centre where the cost of living and other lifestyle factors differ from other regions in NZ.

*Objective 2: To investigate whether sociodemographic factors, such as age, gender, deprivation index, income, parent/caregiver education level, household size, ethnicity and geographical location, are associated with low or moderate to high nutrition risk in NZ preschool children*

This study found inequities between preschool children at moderate to high versus low nutrition risk for single parent household, low income, non-NZ European and low parental education factors. These results support previous research that sociodemographic factors

were associated with poorer nutrition habits (Parikka et al., 2018, Bowman and Harris, 2003, Ministry of Health, 2017a, Morton et al., 2017, Ministry of Health, 2008). In addition, these factors have been associated with health inequity, which can occur when social and economic factors influence whether a person will experience poor health outcomes (World Health Organization, 2008) (Howden-Chapman and Tobias, 2000). For preschool children this means they can be at higher risk of experiencing poor health outcomes due to the economic status of their parents, their ethnicity or other social factors and this study found these disparities may additionally impact their nutrition risk. Any nutrition interventions aimed at improving nutrition habits in NZ preschool children need to take these inequities into account. The sociodemographic factors associated with increased nutrition risk in this study also often occur concurrently with food insecurity in preschool children in other settings (Bowman and Harris, 2003, Segedin, 2003). Separating food insecurity from other factors influencing nutrition risk is challenging.

Comparison of the preschool children in this study at low and moderate to high nutrition risk found no significant difference between geographical location (North vs South Island), deprivation index for their residential address or parent and child gender or age.

*Objective 3: To identify key risk responses that contribute to nutrition risk among NZ preschool children*

The areas of increased nutritional concern among NZ preschool children were identified by the responses to each NutriSTEP item (score  $\geq 2$ ). The key areas where more than 30% of NZ preschool children were not meeting current recommendations included daily intake of grains, fruit, vegetables, milk and milk products, meat and meat alternatives. Having an inadequate intake of all of these food groups poses an increased risk of suboptimal intakes and subsequent nutritional deficiencies. It further supports the development of poor eating patterns which may persist into adulthood and increase the risk of diet-related diseases later in life. In addition, to having a low intake of all major food groups, NZ preschool children had excessive exposure to screens during meal times which may contribute further to poor eating habits by encouraging either over- or under eating or poor food choices due to the distraction from screens. The overuse of supplements in more than 30% of preschool children in this study is contrary to the Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2 –18 years), which recommends obtaining nutrients from foods rather than

supplements and if regularly used, may result in excessively high intakes of some vitamins and minerals (Ministry of Health, 2012a).

#### 4.1. Strengths

Strengths of this research were the relatively large sample size with an even distribution of participants across NZ deprivation indices and an even distribution of female and male preschool children. NutriSTEP is a validated and reliable tool that has been adapted for use in the NZ setting (Edge, 2019). It has been found to be an efficient, convenient and reliable tool for identifying nutrition risk in NZ preschool children. Additionally, NutriSTEP has been validated for use both online and in-person (Carducci et al., 2015, Randall Simpson et al., 2008). Using an online survey application, allowed for a convenience sampling method to reach parents and caregivers throughout NZ. Geographic location did not limit the ability to participate in this study.

The study identified areas of nutritional concern and the sociodemographic characteristics of preschool children at highest nutrition risk.

#### 4.2. Limitations

Due to the convenience sampling method used to reach participants, the parents who completed the survey may have been a biased subset of NZ preschool children which may not accurately reflect the entire population. External factors may play a part in whether a parent chooses to participate. For example, busy parents may be less likely to complete the survey due to time restraints, parents may feel some embarrassment about their child's nutrition habits and choose not to complete the survey (confidentiality was provided to all participants in this study to minimise the impact of this). In addition, those who consider their child has 'good' nutrition habits or parents who are more knowledgeable or interested in their child's nutrition habits may be more inclined to complete the survey. As this was an online survey and parents and caregivers were proxy reporting on behalf of their child, this may have increased the risk of bias from inaccurate reporting (Börnhorst et al., 2013). Generalisability of findings may also have been limited due to the collection of data from an online survey.

As NutriSTEP items assessed frequency of eating from each food group rather than portion size eaten at each meal comparison with dietary guidelines need to be interpreted with caution.

The spread of ethnicities in this research study did not provide a sufficient sample size to statistically analyse nutrition risk for each ethnicity. Therefore, the ethnicities were grouped as NZ European vs Non-NZ European to provide a sufficiently large sample size for statistical analysis.

#### 4.3. Final Recommendations

This study has highlighted opportunities for further research and interventions in NZ preschool children. A larger scale study could be undertaken in the two to five-year age group to further explore nutrition risk among vulnerable preschool children. Screening could take place through childcare centres, General Practitioners and child health organisations such as Plunket to allow a wider reach to a broad range of participants. A larger study with a more diverse sample may allow for more robust findings that could be used to further target nutrition interventions. Interventions could include a family-based approach and provide parents with simple and positive nutrition education, which is appropriate for preschool children. Some examples are cooking sessions with families, edible gardens and nutrition education sessions. In NZ, the government fully funds 20 hours of early childhood education for three- and four-year olds meaning even the most disadvantaged preschool children have the opportunity to attend kindergartens, preschools, early childcare centres and Kohanga Reo. It is estimated that almost 90% of four-year olds attend some form of early childhood centre, therefore, interventions in these settings can to some extent address social inequity by involving all children and their families.

In addition, community-based approaches which include nutrition screening through medical centres and parenting organisation such as Plunket may help to identify preschool children at highest nutrition risk who may benefit from further assessment and support from a Registered Dietitian. NutriSTEP can also be conveniently self-administered by parents and caregivers and there is potential to provide access to downloadable nutrition information and websites.

#### 4.4. Conclusion

One-fifth of NZ preschool children in this study had inadequate nutrition habits and a third or more were not meeting nutrition requirements for all main food groups, increasing the risk of an inadequate intake of key nutrients and may increase their risk of diet related diseases later in life. In addition, over a third of NZ preschool children in this study were regularly watching screens during meals, which can negatively impact the amount and type of food eaten in a

meal and increase the risk of overweight, obesity and poor regulation of food intake.

Supplement use was excessive for more than a third of NZ preschool children in this study, the Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2 –18 years) recommends nutrients come from food and supplementing may increase the risk of exceeding recommended upper limits for vitamins and minerals. Preschool children who were non-NZ European, from households with lowest incomes, with solo and lower educated parents were at highest nutrition risk, indicating social inequity is impacting nutrition intake and behaviours in these NZ preschool children.

This is consistent with previous research that has found poor nutrition habits and higher rates of nutrition related disease in lower socioeconomic groups (Gerritsen et al., 2018). These sociodemographic characteristics have also been associated with an increased risk of food insecurity (Carter et al., 2010, Hopgood et al., 2010, Segedin, 2003, van Ansem et al., 2014). NutriSTEP may be a useful tool to identify preschool children at high nutrition risk amongst the most vulnerable households who may be experiencing social inequity and food insecurity.

Overall, NutriSTEP is a valid nutrition screening tool and can help identify preschool children at highest nutrition risk. It can conveniently be self-administered by parents and used through child care centres and health professionals to identify preschoolers at highest risk for whom appropriate interventions can be recommended.

## 5. References

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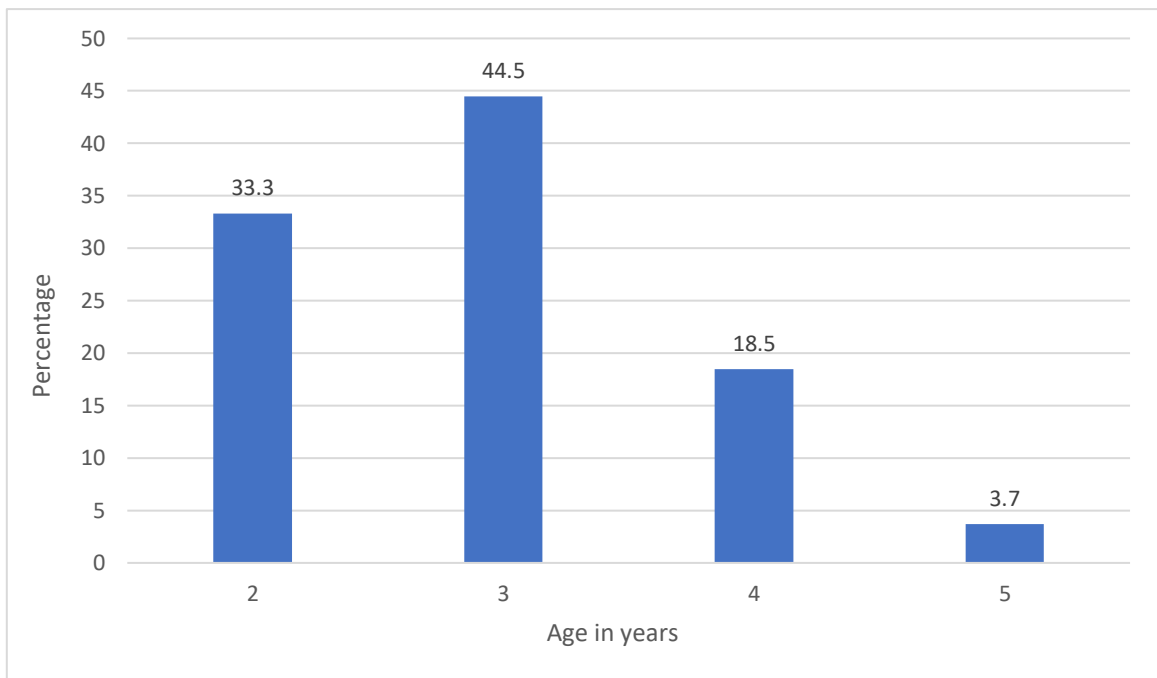
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## Appendix A – Supplementary Results

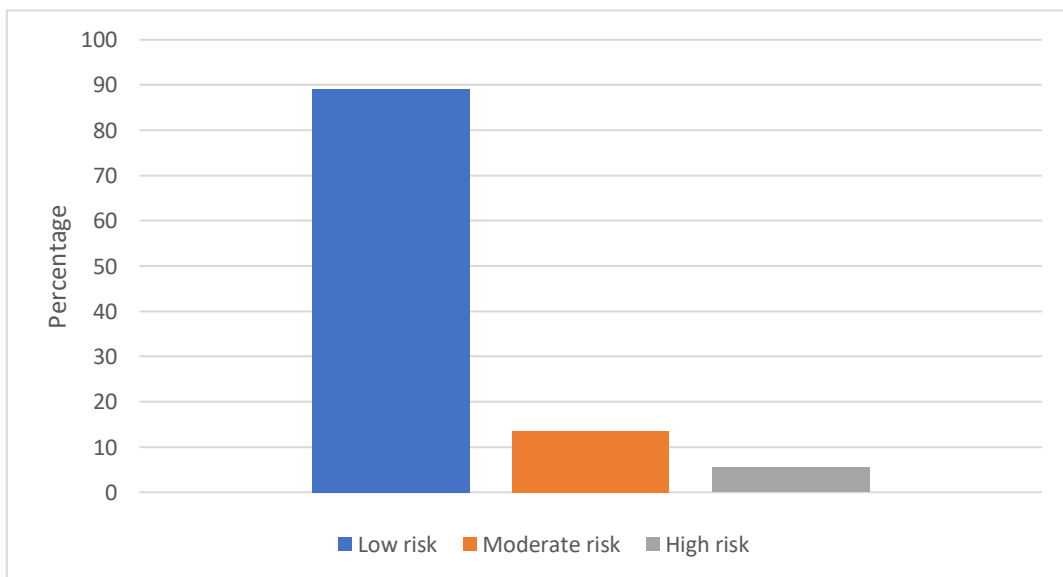
**Table A.1. NutriSTEP risk items by children at low and moderate/ high nutrition risk**

NutriSTEP Item	Low risk n(%) 409 (81%)	Moderate/ high risk n(%) 96(19%)
1. My child usually eats bread, cereals and grain products:		
≥4 x per day†	185 (45.2)	15 (15.6)
<4 x per day	224 (54.8)	81 (84.4)
2. My child usually has milk and dairy products:		
≥2 x per day†	356 (87)	73 (76.0)
<2 x per day	53 (13)	23 (24.0)
3. My child usually eats fresh fruit:		
≥2 x per day†	381 (93.2)	64 (66.7)
<2 x per day	28 (6.8)	32 (33.3)
4. My child usually eats vegetables:		
≥2 x per day†	311 (76)	29 (30.2)
<2 x per day	98 (24)	67 (69.8)
5. My child usually eats meat, fish, poultry or alternatives:		
≥1 x per day†	386 (94.4)	71 (74.0)
<1 x per day	23 (5.6)	25 (26.0)
6. My child usually eats “fast food”:		
>1 x per week	6 (1.5)	14 (14.6)
≤1 x per week	403 (98.5)	82 (85.4)
7. I have difficulty buying food to feed my child because food is expensive:		
Never to rarely	319 (78)	54 (56.3)
Sometimes to always	90 (22.0)	42 (43.7)
8. My child has problems chewing, swallowing, gagging or choking when eating:		
Never to rarely	392 (95.8)	81 (84.4)
Sometimes to always	17 (4.2)	15 (15.6)
9. My child is not hungry at mealtimes because he/she drinks all day:		
Never to rarely	363 (88.8)	52 (54.2)
Sometimes to always	46 (11.2)	44 (45.8)
10. My child usually eats:		
≥3 x per day	409 (100)	96 (100)
<3 x per day	0 (0)	0 (0)
11. I let my child decide how much to eat:		
Always to most of the time	347 (84.8)	75 (78.1)
Sometimes to never	62 (15.2)	21 (21.9)
12. My child eats meals while watching TV or other digital devices:		
Never to sometimes	397 (97.1)	74 (77.1)
Most of the time to always	12 (2.9)	22 (22.9)
13. My child usually takes supplements:		
Never to sometimes	339 (82.8)	49 (51)
Most of the time to always	70 (17.2)	47 (49)
14. My child:		
Gets enough physical activity	390 (95.4)	77 (80.2)
Needs more physical activity	19 (4.6)	19 (19.8)
15. My child usually watches TV, uses the computer/other devices, and plays video games:		
≤2 hours	392 (95.8)	80 (83.3)
>2 hours	17 (4.2)	16 (16.7)
16. I am comfortable with how my child is growing:		
Yes	408 (99.8)	88 (91.7)
No	1 (0.2)	8 (8.3)
17. My child:		
Is about the right weight	397 (97.1)	71 (74)
Should weigh more/less	12 (2.9)	25 (26)

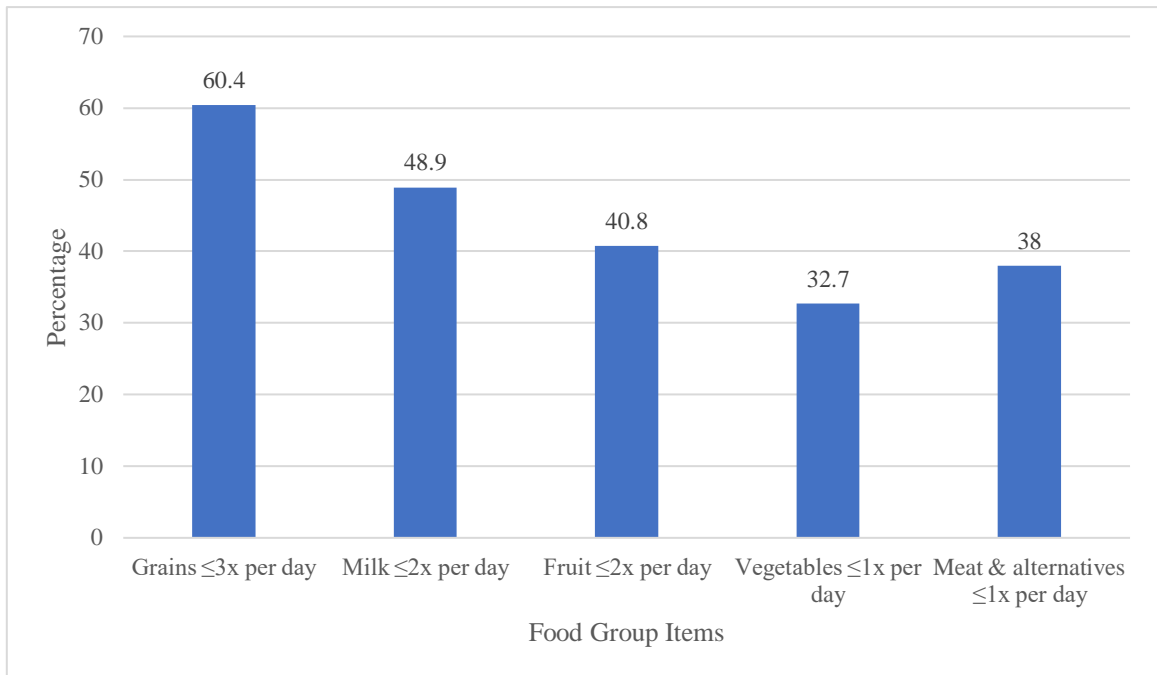
†TMOH recommended food group serves per day for preschool children.



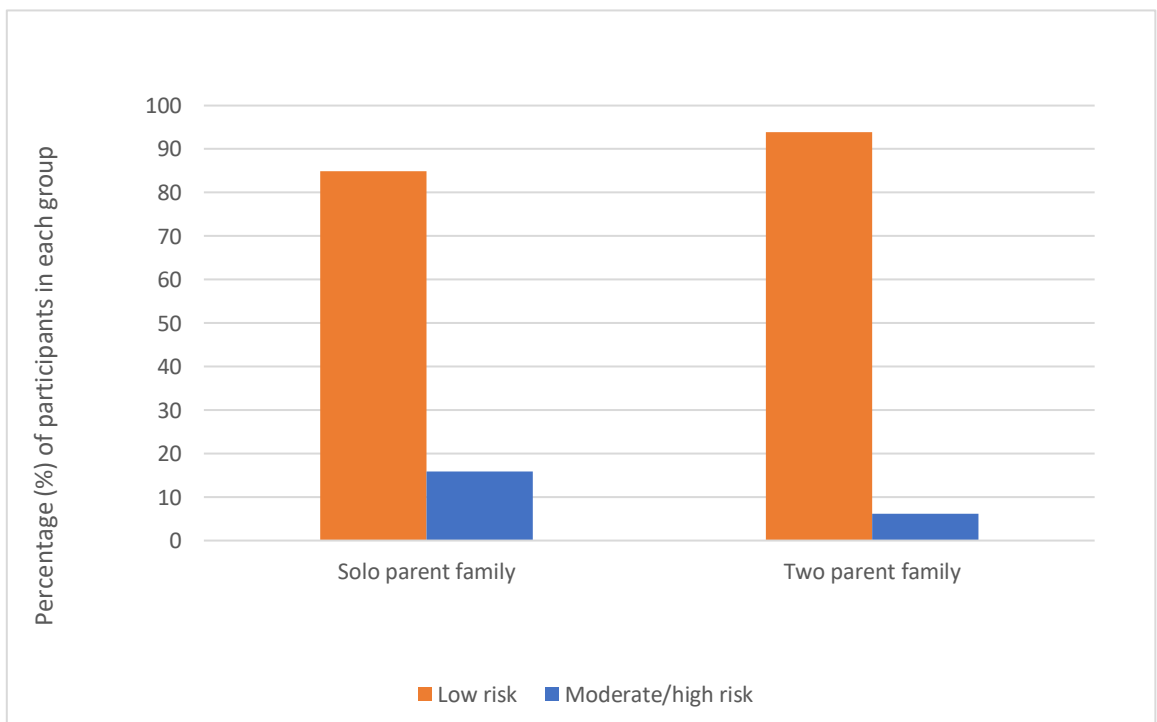
**Figure A.1 Age distribution of all participants in the study**



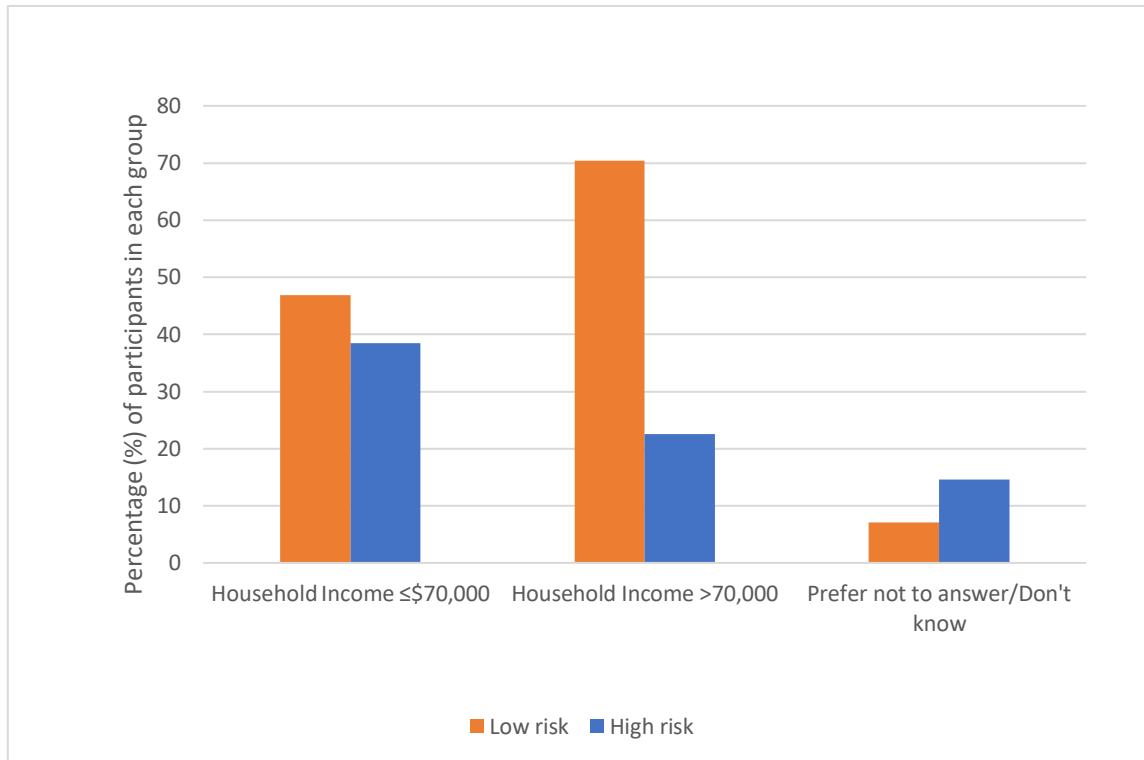
**Figure A.2 Percentage of children at low, moderate and high risk**



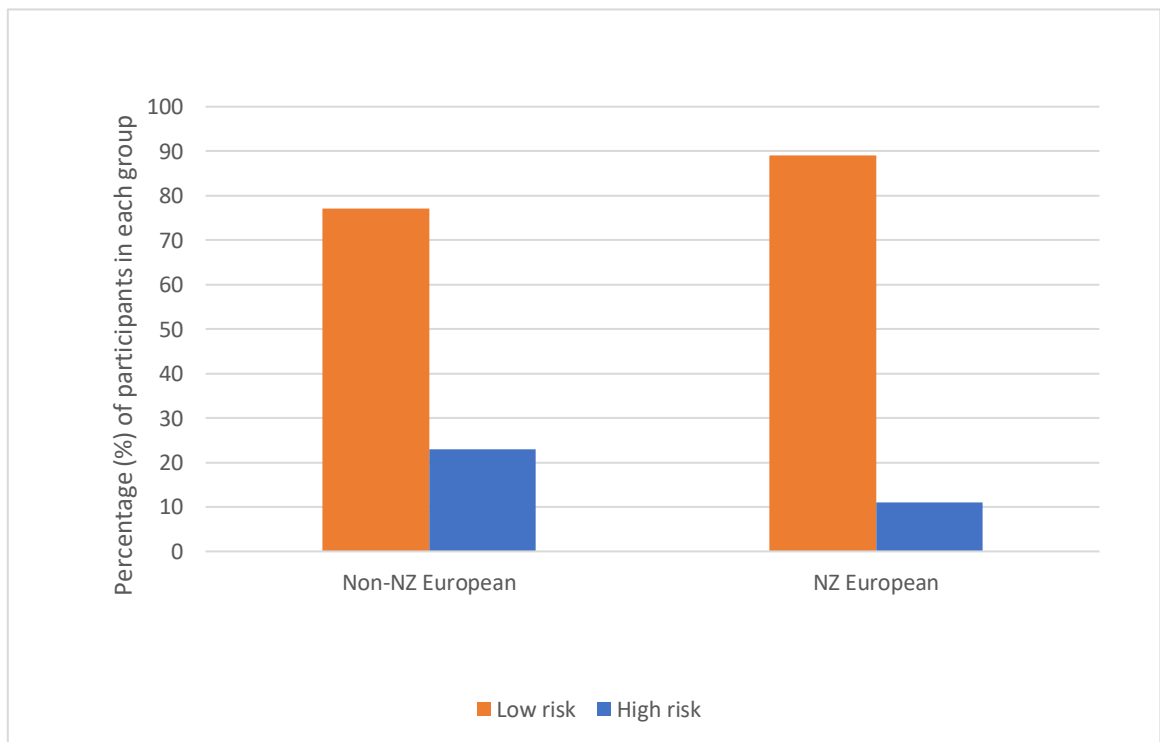
**Figure A.3 Percent of participants with high risk answers for food groups in NutriSTEP**



**Figure A.4 Comparison of Household composition between low risk and moderate/high risk group**

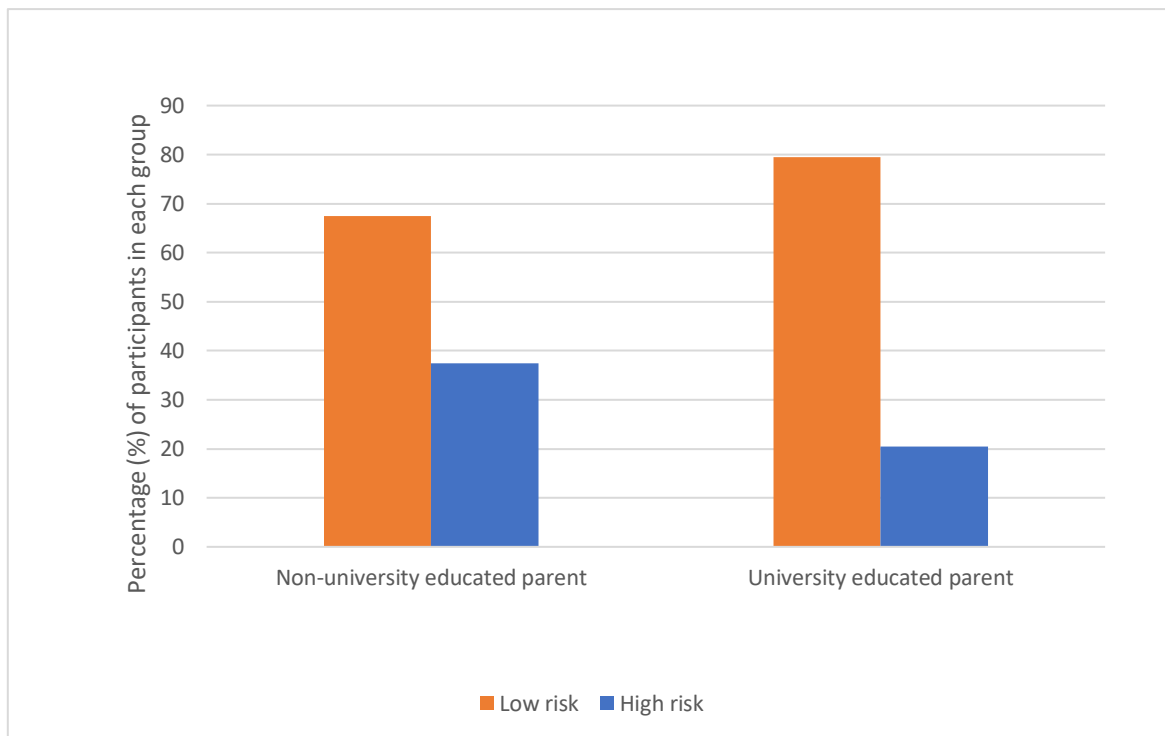


**Figure A.5 Comparison of household income between low risk and moderate/high risk groups**



**Figure A.6. Comparison of ethnicity between low risk and moderate/high risk groups**





**Figure A.7 Comparison of parental education between low risk and moderate/high risk groups**

## Appendix B – Materials Used

### B1. Recruitment advertisement



UNIVERSITY OF NEW ZEALAND

School of Sport, Exercise and Nutrition  
Massey University  
Private Bag 102904  
North Shore City  
Auckland  
0754  
New Zealand

## Do you have a child aged between 2-5 years?

We are looking for parents, guardians or main caregivers of at least one child aged between 2-5 years old to take part in a study investigating the prevalence and determinants of healthy eating among preschool children in New Zealand.

The study will help to identify risk factors for poor nutrition in preschool aged children. The findings from the research may assist with future nutrition interventions to help improve the health of New Zealand preschool children.



The study is conducted via an online survey and takes 25-30 minutes to complete and can be done in your own time and at a time that suits you. If you are interested you can read more about it and complete the survey here [\[insert hyperlink to survey\]](#).

On completion of the survey participants will be invited to enter the draw to go in to win a \$100 supermarket voucher.

If you would like more information you can contact the researcher: [h.ross@massey.ac.nz](mailto:h.ross@massey.ac.nz), MSc Nutrition and Dietetic Student.

## B2. Recruitment poster



**Interested in  
food and nutrition  
for pre-schoolers?  
Is your child  
aged between  
2-5 years?**

Complete a **10 minute online questionnaire** and  
go in the draw to WIN a \$100 shopping voucher.

To find out more and  
access the  
questionnaire:

- scan the QR code; 
- or
- **Contact:** Helen Ross  
MSc Nutrition &  
Dietetics Student  
h.ross@massey.ac.nz  
021 413 578



**MASSEY**  
UNIVERSITY  
TE KUNINGA KI PŪREHUROA  
UNIVERSITY OF NEW ZEALAND

### B3. Facebook advertisement



#### Nutrition and Preschool Children in NZ - Research

Sponsored · 🌐

We are looking for parents/caregivers of children aged 2-5 years old to take part in our study on eating habits of pre-school children in New Zealand.

**\*\*We value your opinion and really appreciate your time! Complete the 10 minute online questionnaire and go in the draw to WIN a \$100 shopping voucher!\*\***

Find out more about the study and access the questionnaire here

<https://forms.gle/XTVWbKzNSSRUZbF56>



**Do you have a child between  
the age of 2 and 5 years?**

**B4. Information sheet**

School of Sport, Exercise and Nutrition  
 Massey University  
 Private Bag 102904  
 North Shore City  
 Auckland  
 0754  
 New Zealand

**The prevalence and determinants of healthy eating among preschool children aged  
 2-5 years old in New Zealand**

**INFORMATION SHEET**

**Researcher Introduction**

This project is being undertaken by Helen Ross for her thesis to complete a Master of Science in Human Nutrition and Dietetics. The project will be supervised by Associate Professors Carol Wham and Rozanne Kruger from the School of Sport, Exercise and Nutrition. The project aims to investigate the prevalence and determinants of healthy eating among preschool children in New Zealand aged between 2 and 5 years old.

**Project Description and Invitation**

Inadequate nutrition during infancy and early childhood is associated with a range of health issues such as nutrient deficiencies, poor growth and development, obesity and nutrition related disease (Gerritsen et al., 2018). Childhood micronutrient deficiencies can have short- and long-term consequences to academic performance and cognitive function (Scrimshaw, 1998).

Identifying those most at risk of poor nutrition is the first step to providing an intervention and access to services such as Dietitians and other health professionals. This research will investigate nutrition habits of preschool children aged 2 to 5 years old in rural and suburban areas of New Zealand and aims to include a wide range of ethnicities and socio-economic backgrounds. The findings of the research will provide an indication of where to focus resources in an effort to improve nutrition of preschool children most at risk of poor nutrition.

The NutriSTEP questionnaire has been chosen as the research tool for this study. This questionnaire has been developed in Canada and is validated for use in the New Zealand population. It contains 17 questions on food intakes from main food groups (grains, dairy, protein, vegetables, fruit fast food, drinks) and eating behaviours (screen time, eating difficulties, eating patterns, portion sizes, supplements and physical activity).

You have been invited to take part, as a parent, guardian or main caregiver of a child aged 2-5 years old and their nutrition risk status. If you choose to take part in this study you will be required



to complete an online demographics questionnaire and a 17-item online NutriSTEP questionnaire prior to 15 August 2019.

If you would prefer not to take part, then you do not need to and you do not have to need to give a reason. If you do want to take part, but change your mind later you can exit the study at any time.

This information sheet is provided to help you to decide whether you would like to take part. It explains why we are doing the study, what your participation involves and any benefits or risks to you.

Prior to deciding feel free to talk to other people, such as family, whānau, friends, or healthcare providers. You will be asked if you agree to take part in this study before completing the questionnaire.

This information sheet is 4 pages long. Please make sure you have read and understand each page.

### **Participant Identification and Recruitment**

Parents/primary caregivers of preschool aged children will be invited to participate by recruitment through preschools, kindergartens and early childhood centres that their child attends and through social media, flyers and advertising. Recruitment phone calls will be made to preschool centres Auckland wide asking for interest of involvement. Preschools, kindergartens and early childhood centres that are willing to advertise the study will be emailed an information pack containing the research advertisement, information sheet, demographics questionnaire and NutriSTEP questionnaire.

Participant names will not be necessary. Participants will be instead given an ID number to identify with to ensure privacy and personal information are kept confidential. As the questionnaire is to remain anonymous completion of the questionnaire will indicate consent, however the questionnaire can be stopped at any time prior to submitting to the researcher.

### **Selection criteria**

- Being a parent/primary caregiver of a preschool child (two to five years old)
- Having lived in New Zealand for the last 5 years
- Be able to read and write in English.

This research project is aiming for the recruitment of around 700 parents. This number is to ensure all ethnicities, groups and cultures living in New Zealand are represented as equally as possible and allows for a statistically significant sample size.

## **Project Procedures**

Parents who consent to be involved in the research are invited to:

- 1) Complete an online version of the adapted NutriSTEP tool
- 2) Complete a questionnaire online which will involve questions about your: gender, ethnicity, age, number of children, marital status, income, education and language that you mostly speak.

### **Time involved.**

#### **2) Online Questionnaires**

- a) A maximum of 15 minutes for the completion of the online version of the NutriSTEP tool. This is completed on a personal device of the participants, at a time that suits the participant.
- b) A maximum of 15 minutes for the completion of the demographic questionnaire online via the survey link Google Survey. This is completed on a personal device of the participants, at a time that suits the participant.
- c) This results in a total of 30 minutes for participation in this research project.

## **Data Management**

### **Use of data.**

Data will be collected from the results of the participants completing the NutriSTEP tool and the demographic questionnaire from each participant (a total of 2 completed items).

### **What will happen to the data when it is obtained.**

Scores from the NutriSTEP tool will be compared using SPSS statistical software to identify trends in the data and investigate the prevalence and determinants of healthy eating in preschool age children in New Zealand. The demographic questionnaire will be required to identify children that may have increased nutrition risk due to non-diet related factors.

### **Storage and disposal of data.**

Data collected from the online version of the adapted NutriSTEP and the online demographic questionnaire will be kept only on the researcher's personal electronic device, secured by a password only known to the researcher. Any paper collected will be shredded by a paper shredder.

### **Method for accessing a summary of the project findings.**

A summary of results from the study will be made available to all participants of the study and this information will be sent via email.

### **Method for preserving confidentiality of identity**

Participants identity and confidentiality will remain strictly private as ID numbers in place of given names will be used. This ensures privacy, confidentiality and anonymity are upheld during this research process.

### **Participant's Rights**

You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- withdraw from the study at any time;
- ask any questions about the study at any time during participation;
- provide information on the understanding that your name will not be used unless you give permission to the researcher;
- be given access to a summary of the project findings when it is concluded.
- you have the right to decline to answer any particular question.
- completion and return of the questionnaire implies consent. If at any point you choose to stop the questionnaire and withdraw from the study, consent is not implied and your answers will not be included in the research.

### **Project Contacts**

Please contact the researcher at any time if you have any questions about this research project.

Helen Ross  
Student Dietitian, Massey University Albany  
Phone: 021 13 578  
Email: h.ross@massey.ac.nz

### **Committee Approval Statement:**

This project has been reviewed and approved by the Massey University Human Ethics Committee: Northern, Application NOR 19/30. If you have any concerns about the conduct of this research, please contact Associate Professor David Tappin (Committee Chair), Massey University Human Ethics Committee: Northern, email humanethicsnorth@massey.ac.nz.



**B5. Consent Form**

School of Sport and Exercise and Nutrition  
Massey University  
Private Bag 102904  
North Shore City  
Auckland  
0754  
New Zealand

**Eating habits among preschool aged children 2-5 years old in New Zealand.**

**PARTICIPANT CONSENT FORM - INDIVIDUAL**

I have read the Information Sheet and have had the details of the study explained to me. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I agree to participate in this study under the conditions set out in the Information Sheet.

**Signature:** ..... **Date:** .....

**Full Name - printed** .....

**B6. Study Survey including demographic  
and NutriSTEP with scoring**



School of Sport and Exercise and Nutrition  
Massey University  
Private Bag 102904  
North Shore City  
Auckland  
0754  
New Zealand

**Demographic Questionnaire**

As part of this research we need to ask you some questions in relation to your household, income, education, ethnicity and age. These questions relate to you and one child (aged 2-5 years old) for whom you are a parent or main caregiver. The information you provide in this questionnaire is confidential and no identifying information will be used in any publications from this study. Thank you very much for taking the time to complete this questionnaire.

**1. Please type the ID number that you received in this email (e.g B1)**

\_\_\_\_\_

**2. Email Address:**

**3. Your Home Address**

_____	_____	_____
Street no.	Street Name	Suburb
_____		_____
Town/City	Post Code	

**4. What is your date of birth?**

\_\_ / \_\_ / \_\_\_\_ (Day/Month/Year)

**5. Where were you born:**

**Town/City**\_\_\_\_\_

**Country**

New Zealand

Other, please state: \_\_\_\_\_

**6. How long have you lived in New Zealand?**

Always lived in New Zealand ☐

Less than one year ☐

2–3 years ☐

4 or more years ☐

Don't know ☐

**7. Your Gender?** Male Female Other, please state:

**8. (a) What is your current weight?** \_\_\_\_\_

I don't know ☐

Prefer not to answer ☐

**9. (a) What is your current height?** \_\_\_\_\_

I don't know ☐

Prefer not to answer ☐

**10. Which ethnic group do you belong to? Please select one which you identify with first and foremost**

New Zealand Māori ☐

New Zealand European/Pākehā ☐

Pasifika ☐

Asian ☐

Other: Please state \_\_\_\_\_

**11. Do you identify with any other ethnic group or groups? (select any that apply)**

New Zealand Māori ☐

New Zealand European/Pākehā ☐

Pasifika ☐

Asian ☐

Other: Please state \_\_\_\_\_

**12. Please describe your relationship to the child?**

- Mother ☐
- Father ☐
- Step-Mother or Step-Father ☐
- Caregiver – family ☐
- Caregiver – crèche/kindergarten ☐
- Other ☐

Please state: \_\_\_\_\_

**Now we are going to ask you some questions about the child for whom you are parent or caregiver.**

**13. Does the child usually live with you?**

- Yes, all the time ☐
- Yes, most of the time (more than 50% of the time but less than 100%) ☐
- No (less than 50% of the time) ☐

**14. What is the child's date of birth?**

\_\_\_ / \_\_\_ / \_\_\_\_ (Day/Month/Year)

**15. Where was the child born?**

**Town** \_\_\_\_\_

**Country:**

New Zealand

Other, please state: \_\_\_\_\_

**16. Child's gender? Male Female****17. (a) What is the child's current weight? \_\_\_\_\_**

I don't know; or  
prefer not to answer

**(b) When was this last measured** \_\_\_ / \_\_\_ / \_\_\_\_ (Day/Month/Year)

I don't know;

**18. (a) What is the child's current height? \_\_\_\_\_**

I don't know

**(b) When was this last measured** \_\_ / \_\_ / \_\_\_\_ (Day/Month/Year)

I don't know

**19. Which ethnic group does the child belong to? Please select one which your child identifies with first and foremost**

New Zealand Māori ☐

New Zealand European/Pākehā ☐

Pasifika ☐

Asian ☐

Other: Please state \_\_\_\_\_

**20. Does your child identify with any other ethnic group or groups? (select any that apply)**

New Zealand Māori ☐

New Zealand European/Pākehā ☐

Pasifika ☐

Asian ☐

Other: Please state \_\_\_\_\_

**HOUSEHOLD & EDUCATION**

**Now, we are going to ask some questions about your household and education. These answers help us to ensure we have selected a representative sample of New Zealand parents and caregivers to participate in this survey, and sometimes these things can affect our nutrition and health.**

**21. Please select the option that best describes your household in relation to the child?**

"Single parent/ caregiver family" (i.e., no other partner/spouse/caregiver)

☐

"Two-parent/caregiver family" (i.e., respondent is mother or father (biological or foster/adoptive) or caregiver with one other partner/spouse)

☐

"Extended family" (i.e., respondent is mother or father (biological or foster/adoptive) or caregiver with one other partner/spouse and other relatives but not friends/flatmates/other)

☐

Other households (none of the above)

☐

**22. What is the total income that your household got from all sources, before tax or anything was taken out of it, in the last 12 months?**

Loss ☐

Zero income ☐

\$1 – \$5,000 ☐

\$5,001 – \$10,000 ☐

\$10,001 – \$15,000 ☐

\$15,001 – \$20,000 ☐

\$20,001 – \$25,000 ☐

\$25,001 – \$30,000 ☐

\$30,001 – \$35,000 ☐

\$35,001 – \$40,000 ☐

\$40,001 – \$50,000 ☐

\$50,001 – \$60,000 ☐

\$60,001 – \$70,000 ☐

\$70,001 – \$100,000 ☐

\$100,001 – \$150,000 ☐

\$150,001 or more ☐

Don't know ☐

Prefer not to answer ☐

**23. During the past 5 years, what was your paid occupation or job title? (e.g. teacher, veterinarian, dairy farmer, librarian, social worker, receptionist etc.)?**

Please state: \_\_\_\_\_

***(Or fill in "not in paid work" if you were unemployed, a student, a stay-at-home parent or a homemaker for most of the time during the past 5 years.)***

**24. What is the highest level of education you have completed?**

- Primary School ☐
- Secondary School (College e.g. School Certificate, Bursary, NCEA level 1-3) ☐
- Trade Certificate or Diploma ☐
- University or other tertiary education ☐
- Other (please state) ☐ \_\_\_\_\_

**25. In the last 4 weeks how many people have lived in your household? (including yourself)**

- 1 ☐
- 2 ☐
- 3 ☐
- 4 ☐
- 5 ☐
- 6 ☐
- 7 ☐
- 8+ ☐

**26. How many of these household members contribute to the household income?**

- 1 ☐
- 2 ☐
- 3 ☐
- 4 ☐
- 5 ☐
- 6 ☐
- 7 ☐
- 8+ ☐

**27. How many adults live in your household?**

1 ☐

2 ☐

3 ☐

4+ ☐

**28. How many children live in your household?**

1 ☐

2 ☐

3 ☐

4+ ☐

**29. Would you like to receive a brief report summarising the main findings of the project?**

Yes ☐

No ☐

**30. Are you willing to be contacted in future research projects within the Massey University School of Sport, Exercise and Nutrition?**

Yes ☐

No ☐

**The survey is now complete.**

**Thank you for your time to complete this survey**



NutriSTEP questionnaire with scoring



## Nutrition Behaviour Questionnaire for Parents of Preschoolers

### Instructions

- Below are questions about your preschool child's (2-5 years-old) eating and other habits.
- Please complete the questions yourself or with the help of others who take care of your child.
- Tick (✓) only one answer for each question.
- Think about your child's *usual* habits when answering each question.
- The word "times" in the response section refers to at least a half standard serving of food offered at a single eating occasion

---

1. My child usually eats bread, cereals and grain products:

*Examples are bread, buns, breakfast cereals (i.e. Weetbix, porridge), pasta, rice, roti, wraps and crackers.*

- ☐ **More than 5 times a day**
- ☐ **4-5 times a day**
- ☐ **2-3 times a day**
- ☐ **Less than 2 times a day**

Q1 Scoring:
0= More than 5 times a day
1= 4 to 5 times a day
2= 2 to 3 times a day
4=Less than 2 times a day

2. My child usually has milk and dairy products:

*Examples are cow's milk, flavoured milk (i.e. chocolate), cheese, yoghurt, custard, dairy foods and fortified soy milk.*

*(This excludes almond, rice and coconut milks and products).*

- ☐ **More than 3 times a day**
- ☐ **3 times a day**
- ☐ **2 times a day**
- ☐ **Once a day or less**

Q2 Scoring:
0= More than 3 times a day
1= 3 times a day
2= 2 times a day
4= Once a day or less

3. My child usually eats fresh fruit:

- ☐ **More than 3 times a day**
- ☐ **3 times a day**
- ☐ **2 times a day**
- ☐ **Once a day**
- ☐ **Not at all**

Q3 Scoring:
0= More than 3 times a day
1= 3 times a day
2= 2 times a day
3= Once a day
4= Not at all

4. My child usually eats vegetables:

- ☐ **More than 2 times a day**
- ☐ **2 times a day**
- ☐ **Once a day**
- ☐ **Not at all**

Q4 Scoring:
0= More than 2 times a day
1= 2 times a day
3= Once a day
4= Not at all

5. My child usually eats meat, fish, poultry or alternatives:

*Alternatives can be eggs, peanut butter, tofu, nuts, or dried beans, peas and lentils.*

- ☐ **More than 2 times a day**
- ☐ **2 times a day**
- ☐ **Once a day**
- ☐ **A few times a week**
- ☐ **Not at all**

Q5 Scoring:
0= More than 2 times a day
1= 2 times a day
2= Once a day
3= A few times a week
4= Not at all

6. My child usually eats “fast food”:

- ☐ **4 or more times a week**
- ☐ **2-3 times a week**
- ☐ **Once a week**
- ☐ **A few times a month**
- ☐ **Once a month or less**

Q6 Scoring:
4= 4 or more times a week
3= 2 to 3 times a week
2= Once a week
1= A few times a month
0= Once a month or less

7. I have difficulty buying food to feed my child because food is expensive:

- ☐ **Always**
- ☐ **Most of the time**
- ☐ **Sometimes**
- ☐ **Rarely**
- ☐ **Never**

Q7 Scoring:
4=Always
4= Most of the time
2= Sometimes
1= Rarely
0= Never

8. My child has problems chewing, swallowing, gagging or choking when eating:

- ☐ **Always**
- ☐ **Most of the time**
- ☐ **Sometimes**
- ☐ **Rarely**
- ☐ **Never**

Q8 Scoring:
4=Always
4= Most of the time
2= Sometimes
1= Rarely
0= Never

9. My child is **not** hungry at mealtimes **because** he/she drinks all day:

- ☐ **Always**
- ☐ **Most of the time**
- ☐ **Sometimes**
- ☐ **Rarely**
- ☐ **Never**

Q9 Scoring:
4= Always
3= Most of the time
2= Sometimes
1= Rarely
0= Never

10. My child usually eats:

- ☐ **Less than 2 times a day**
- ☐ **2 times a day**
- ☐ **3 to 4 times a day**
- ☐ **5 times a day**
- ☐ **More than 5 times a day**

Q10 Scoring:
4= Less than 2 times a day
3= 2 times a day
1= 3 to 4 times a day
0= 5 to 6 times a day
2= More than 6 times a day

11. I let my child decide how much to eat:

- ☐ **Always**
- ☐ **Most of the time**
- ☐ **Sometimes**
- ☐ **Rarely**
- ☐ **Never**

Q11 Scoring:
0= Always
1= Most of the time
2= Sometimes
3= Rarely
4= Never

12. My child eats meals while watching TV or other digital devices:

- ☐ **Always**
- ☐ **Most of the time**
- ☐ **Sometimes**
- ☐ **Rarely**
- ☐ **Never**

Q12 Scoring:
4= Always
3= Most of the time
2= Sometimes
1= Rarely
0= Never

13. My child usually takes supplements: *Examples are multivitamins, iron drops, fish oil.*

- ☐ **Always**
- ☐ **Most of the time**
- ☐ **Sometimes**
- ☐ **Rarely**
- ☐ **Never**

Q13 Scoring:
4= Always
3= Most of the time
2= Sometimes
1= Rarely
0= Never

14. My child:

- ☐ **Needs more physical activity**
- ☐ **Gets enough physical activity**

Q14 Scoring:
4=Needs more
0=Gets enough

15. My child usually watches TV, uses the computer/other devices, and plays video games:

- ☐ **5 or more hours a day**
- ☐ **4 hours a day**
- ☐ **3 hours a day**
- ☐ **2 hours a day**
- ☐ **1 hour or less a day**

Q15 Scoring:
4= 5 or more hours a day
3= 4 hours a day
2= 3 hours a day
1= 2 hours a day
0= 1 hour a day or less

16. I am comfortable with how my child is growing:

- ☐ **Yes**
- ☐ **No**

Q16 Scoring:
0= Yes
4= No
2= Not sure

17. My child:

- ☐ **Should weigh more**
- ☐ **Is about the right weight**
- ☐ **Should weigh less**

Q17 Scoring:
4= Should weight more
0= Is about the right weight
3= Should weigh less
2= Not sure
99=no answer

**TOTAL SCORE:**

≤20	21-25	>25
<b>Low Risk</b>	<b>Moderate Risk</b>	<b>High Risk</b>