Dietary choices of New Zealand women during pregnancy and lactation

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Abstract

Background: A woman and her offspring's health is affected by the maternal diet during pregnancy and lactation. Because of the importance of the diet, there is a large emphasis on women making optimal dietary choices, as recommended by specific guidelines, in pregnancy and lactation. Dietary recommendations are different from other life stages because of altered nutrient requirements and a heightened need for food safety practices. Currently, there is limited evidence available about dietary choices, food safety practices, and sources of nutrition information of New Zealand women during pregnancy and lactation. This information is important to inform strategies to improve the support that women receive during pregnancy and lactation as it identifies what recommendations are currently being effectively communicated.

Aim: To investigate New Zealand women's dietary choices, food safety practices, and sources of nutrition information during pregnancy and lactation.

Methods: Women from New Zealand were invited to participate in this observational study between January and June 2019. Participants were required to be pregnant or within six months postpartum. Women completed a demographic, pregnancy food frequency, and food choice questionnaire during or retrospectively to their pregnancy. Postpartum women also completed a lactation food frequency and food choice questionnaire.

Results: Women (n=458) consumed a range of foods from the four food groups (fruit and vegetables, breads and cereals, milk and milk products, and meat/meat alternatives/eggs). A large percentage reported adding or increasing, limiting, and avoiding foods. Cow's milk, the most frequently daily consumed dairy product, was more commonly reported in pregnancy (93%) than lactation (64%). A range of fruit, vegetables, protein, and grain foods were consumed daily in pregnancy and lactation. The majority of women followed food safety recommendations in particular avoidance of alcohol (92%), raw milk products (86%), and raw/smoked/precooked fish/seafood (84%). Dietary information was acquired from a range of sources. The greatest dietary influences included midwives, New Zealand pregnancy and breastfeeding guidelines, and family/friends. Women also frequently reported receiving

dietary advice from their lead maternal carer, handouts, the internet, and alternative health practitioners. During lactation, women received information from more potentially unreliable sources including family/ friends, the internet, and alternative health practitioners. Infant symptoms also frequently affected women's food choices in lactation.

Conclusion: Women implement significant dietary changes during pregnancy and lactation. Women are likely to add, remove, and limit food during pregnancy following the New Zealand pregnancy guidelines; advice from health professionals, the internet, magazines/books/newspapers; or because of food safety concerns. Lactating women are likely to make dietary changes because of infant symptoms or advice received from midwives, alternative health practitioners, family/ friends, and the internet.

Acknowledgements

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Table of contents

List of Tables

List of Figures

List of Abbreviations and Symbols

Abbreviation or Symbol	Definition
BMI	Body mass index
DHB	District Health Board
Dr	Doctor
Et al.	and others
FCQ	Food choice questionnaire
FFQ	Food frequency questionnaire
GDM	Gestational diabetes mellitus
GP	General practitioner
GUiNZ	Growing up in New Zealand study
Kg	Kilogram
LMC	Lead maternal carer
mg	Milligram
MSc	Master of Science
NRV	Nutrient reference value
NZ	New Zealand
NZPBG	NZ pregnancy and breastfeeding guidelines
OECD	Organisation for economic co-operation and development
PubMed	Medline Public Publisher
SPSS	Statistical Package for the Social Sciences
WHO	World Health Organisation
%	Percentage
<	Less than
=	Equal to
>	Greater than
≥	Equal to or greater than
±	Plus-minus

Chapter 1: Introduction

1.1. Background

Optimal dietary choices during pregnancy and lactation are important to support the health of both the woman and her offspring (Forbes, Graham, Berglund, & Bell, 2018; Verbeke & De Bourdeaudhuij, 2007). Dietary choices, which are defined by the European Food Information Council as the complex decisions individuals make when choosing and consuming food and beverages, are influenced by a variety of factors during an individual's life course (Furst, Connors, Bisogni, Sobal, & Falk, 1996; The European Food Information Council, 2019). Such factors include culture, food price, habits, personal preferences, level of education, and nutrition knowledge (Coronios-Vargas, Toma, Tuveson, & Schutz, 1992; Furst et al., 1996; The European Food Information Council, 2019). During pregnancy and lactation key factors include the health of the mother and fetus, ethnicity, years of education, age, pregnancy-related symptoms, and socioeconomic status (Coronios-Vargas et al., 1992; Forbes et al., 2018; Fowles & Fowles, 2008; Freisling, Elmadfa, & Gall, 2006; Hurley, Caulfield, Sacco, Costigan, & Dipietro, 2005; Jasti, Siega-Riz, & Bentley, 2003; Morton et al., 2010; Szwajcer, Hiddink, Koelen, & van Woerkum, 2007).

The importance of diet and lifestyle choices during pregnancy and lactation is recognised by the World Health Organisation (WHO), which developed guidelines to support healthcare professionals in 2007 (World Health Organization, 2007). Subsequently, many countries developed guidelines specific to their population groups (Australian Health Ministers' Advisory Council, 2012; National Institute for Health and Clinical Excellence, 2008). In New Zealand (NZ) dietary and lifestyle recommendations during pregnancy and lactation are guided by evidence-based guidelines: "*Food and Nutrition Guidelines for Healthy Pregnant and Breastfeeding Women"* (NZPBG)(Ministry of Health, 2006). The recommendations include a range of topics that are specific to NZ's population group and include analysis on the four food groups (fruit and vegetables, breads and cereals, milk and milk products, and meat/meat alternatives/eggs), weight changes, lifestyle modifications, supplement use, and food safety practices (Ministry of Health, 2006).

During pregnancy and lactation, daily food group recommendations increase, compared to other life stages, to meet women's increased nutritional requirements (Table 1.1) (Ministry of Health, 2006). Additionally, recommendations emphasise including particular foods from the four food groups that are rich sources of protein, dietary fibre, polyunsaturated and monounsaturated fatty acids, and vitamins and minerals such as iron, folate, calcium, and iodine.

Table 1.1. Recommended daily servings of the four food groups shown by life cycle stage (Ministry of Health, 2006, 2013b, 2015a)

Daily recommended serves	Healthy adult	Pregnant	Lactation
Fruit and vegetables [1]	≥ 3 vegetable and ≥ 2 fruit	≥ 4 vegetable and ≥ 2 fruit	≥ 4 vegetable and ≥ 2 fruit
Breads and cereals [2]	≥ 6	≥ 6	≥ 7
Milk and milk products [3]	≥ 2	≥ 3	≥ 3
Meat/ meat alternatives/eggs	≥ 1 meat or ≥ 2 meat alternatives	≥ 2	≥ 2

[1] only 1 serve of fruit juice or 1 serving of dried fruit can be accounted for in total daily fruit and vegetables serves, [2] wholegrain breads and cereals are advised, [3] low or reduced fat dairy products are advised.

There is a wealth of advice on food safety for women during pregnancy. This is because the immunological paradox of pregnancy increases a woman's risk of foodborne illness. The fetus's genetic composition is 50% its mother's and 50% its father's, therefore the woman's immune system perceives it as a foreign body. To ensure fetal survival a woman's immune system is down-regulated during pregnancy (Jamieson, Theiler, & Rasmussen, 2006; Smith, 1999). This downregulation increases a woman's susceptibility to contracting listeriosis, toxoplasmosis, salmonella, botulism, influenza, varicella, and methyl mercury toxicity during pregnancy (Bondarianzadeh, 2007; Jamieson et al., 2006; Pezdirc, Hure, Blumfield, & Collins, 2012; Smith, 1999). Alongside increased susceptibility, women also have an increased risk of infection severity, miscarriage, premature birth, still-birth, and fetal and maternal mortality (Bondarianzadeh, 2007; Donnelly, 2001; Jamieson et al., 2006; Madjunkov, Chaudhry, & Ito, 2017).

Specific foods and food handling techniques have been identified to increase the risk of potential food poisoning during pregnancy. In NZ women are recommended to avoid and/or alter their dietary practices when consuming foods such as; soft cheeses, cold deli salads, cold cooked or smoked meats, processed meats, raw products, soft-serve ice cream, tahini, and ready-to-eat meals (Ministry of Health, 2006).

It is important that nutrition advice is obtained during pregnancy and lactation because of the numerous dietary changes that women are recommended to make (Ministry of Health, 2006). It has been previously identified in NZ that key nutrition information sources for women during pregnancy and lactation include midwives, general practitioners (GP), printed media, friends, and family (Growing Up in New Zealand, 2014). Identifying information sources is important for understanding where women currently obtain dietary information from and potential mediums that could be used for reliable communication to pregnant and/or lactating women in the future.

1.2. Purpose of the study

Dietary recommendations during pregnancy and lactation have become increasingly complex as the evidence on diet, lifestyle, and food safety practices has increased. This makes the recommendations complex to deliver for health professionals and difficult to adhere to for women. Although there is data from a large longitudinal study in NZ on food choices during pregnancy very little evidence exists for lactation (Morton et al., 2014). This information is important to understand how to successfully support women in making optimal dietary choices during pregnancy and lactation and may inform future health promotion strategies. This study aims to investigate women's current dietary choices, if food safety recommendations are being followed, and where dietary information is sourced from during pregnancy and lactation. This study will, therefore, provide valuable information surrounding dietary choices in both pregnancy and lactation.

1.3. Aim

To investigate New Zealand women's dietary choices, food safety practices, and sources of nutrition information during pregnancy and lactation.

1.3.1. Objectives

1. Explore dietary choices during pregnancy and lactation in New Zealand women.
2. Explore food safety practices during pregnancy and lactation in New Zealand women.
3. Explore where New Zealand women get dietary information from during pregnancy and lactation.

1.3.2. Hypotheses

1. During pregnancy and lactation, women's dietary choices will change. Different foods will be removed, limited, and/ or added to the diet.
2. During pregnancy, women's dietary choices will reflect concerns about food safety. Fewer foods will be avoided during lactation.
3. Women will acquire dietary information from a range of sources including their lead maternal carer, GP, internet, friends, and family.

1.4. Thesis structure

This thesis is divided into four chapters. **Chapter one** is an introduction of the background, purpose, aims, objectives, and hypotheses of the study. **Chapter two** is a narrative review of the current literature on women's dietary choices, food safety practices, and nutritional information sources during pregnancy and lactation. **Chapter three** is presented as a manuscript for publication and includes the methods, results, discussion, and reference to relevant appendices. The final chapter, **Chapter four** establishes conclusions and recommendations based on the study findings. **The appendices** include supplementary results, recruitment resources, copies of the questionnaires, and the manuscript prepared for publication.

1.5. Researcher contributions

Table 1.2. Researchers' contributions to this study

Author	Contribution to Thesis
Kimberley Brown MSc Nutrition and Dietetic candidate	Primary author of this thesis and responsible for all study components including leading the research, assisting in the ethics application, part of the team of experts who designed the questionnaires for the study including the demographic, pregnancy and lactation questionnaires, literature review, recruitment, data collection and analysis, interpretation of results, and finalising and submission of thesis chapters and manuscript.
Associate Professor Cath Conlon Academic Supervisor	Academic supervisor, applied for ethics, developed study concept and design, and part of the team of experts who reviewed the questionnaires for the study. Advised about recruitment and data analysis. Assisted in result dissemination. Revised and approved the thesis chapters and manuscript.
Associate Professor Pamela von Hurst Academic Supervisor	Co-supervisor, applied for ethics, developed study concept and design, and part of the team of experts who reviewed the questionnaires for the study. Advised about recruitment and data analysis. Assisted in result dissemination. Revised and approved the thesis chapters and manuscript.
Jeanette Rapson PhD candidate	Applied for ethics, designed research, and part of the team of experts who designed the questionnaires for the study.

Chapter 2: Literature Review

2.1. Introduction

This chapter reviews the current literature on women's dietary choices, food safety practices, and nutrition information sources during pregnancy and lactation. Databases including Massey Discover, Google Scholar, Science Direct, and MEDLINE/ PubMed were utilised to obtain literature. Additionally, Statistics New Zealand and the Ministry of Health websites were used to inform NZ statistics and recommendations. Multiple search terms derived from the study objectives were used (Figure 2.1).

Date searched: May 2018 – October 2019

Search criteria: Nutrients OR nutrition OR feeding OR nutrient recommendations OR required nutrients OR recommended nutrients
Pregnancy OR gestation OR prenatal OR postpartum OR pregnant OR breastfeeding OR lactate OR lactation OR breastfed OR life cycle OR life course
Food choices OR food selection OR food decisions OR food preferences
Food safety OR food handling OR foodborne diseases OR food contamination OR pregnancy complications OR Listeriosis OR Toxoplasma OR Mercury toxicity
Supplements OR folic acid OR folate OR iron OR vitamin OR mineral
Sources of information OR information sources OR health professional OR sources OR nutrition information OR health education OR nutrition education OR food education
New Zealand OR NZ OR Aotearoa OR developed countries OR Australia OR developing countries

Filters: Past 5 years, Past 10 years, Past 15 years

Electronic databases: Massey Discover, Google Scholar, Web of Science, Science Direct, Scopus, Statistics New Zealand, and MEDLINE/ PubMed.

Figure 2.1. Search strategy

2.2. New Zealand birth and population statistics

In 2018, there was 58,020 live births recorded from a total of 58,329 births (Figure 2.2). The number of births decreased by 1,584 (2.6%) compared to 2017 (Ministry of Health, 2019). The annual birth rate has increased by 11% since 1952, causing a steady increase in population size (Statistics New Zealand, 2019).

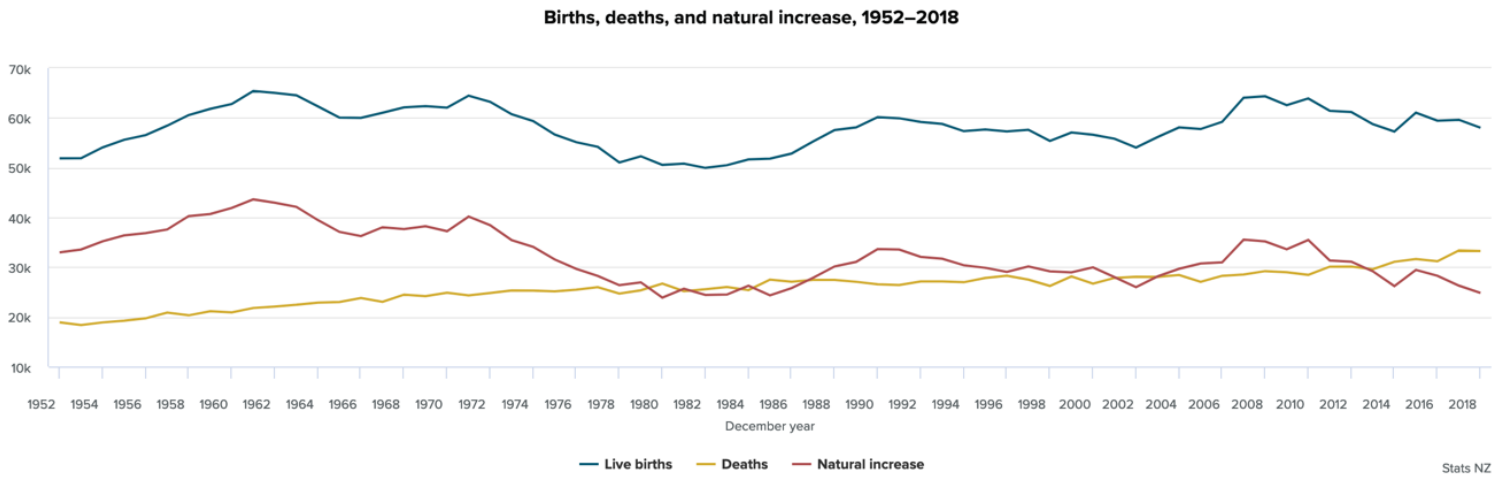

Figure 2.2. NZ birth and death statistics between 1952 and 2018 (Statistics New Zealand, 2019)

The total fertility rate, defined as the age-specific fertility rate represented as a single number of fertility, of women in 2018 was the lowest recorded in NZ history since 1952 (Figure 2.3). This data represents the average predicted number of children women will have if the age-specific fertility rates remain the same throughout their lifetime. A fertility rate of 1.71 suggests that current NZ women will give birth to 1-2 children (Statistics New Zealand, 2019).

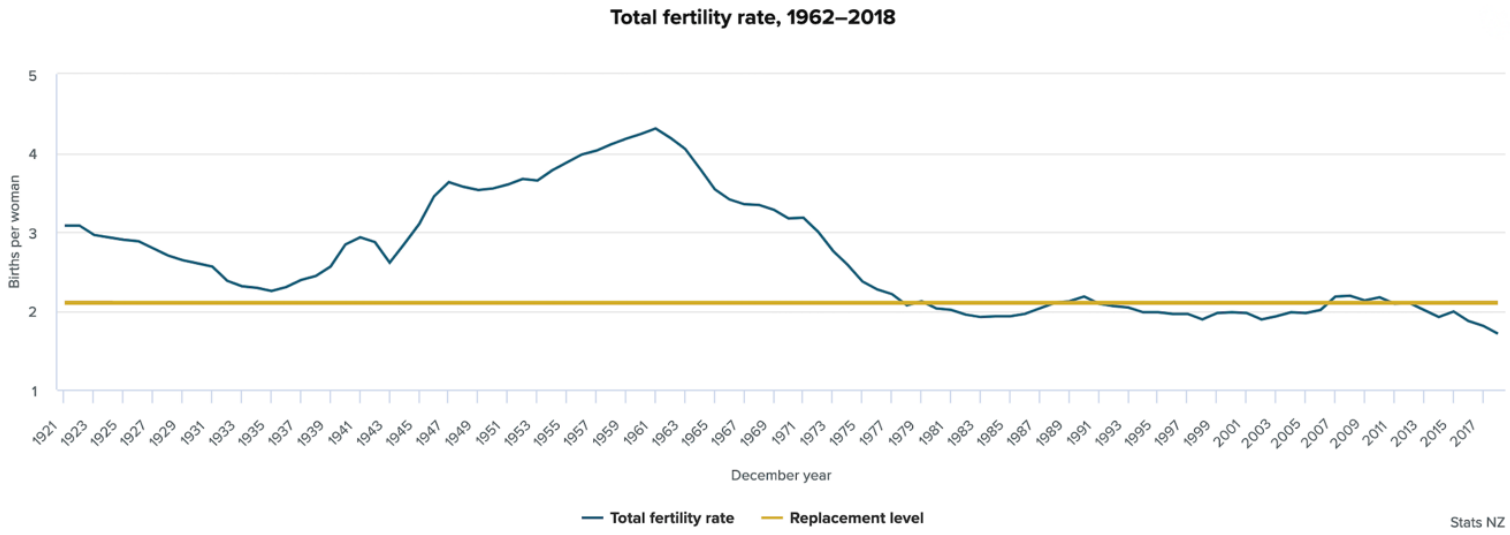

Figure 2.3. Total NZ fertility rates between 1921-2018 (Statistics New Zealand, 2019)

Note: the golden line representing the replacement level statistic suggests that a birth rate of 2.0 is required for population renewal, without migration. This replacement level reflects the average number of babies that women would need to have over their lifetime to maintain the size of the NZ population, excluding changes caused by migration.

In 2018, the median age that NZ women gave birth at was 30.5 years (Figure 2.4). This is the highest recorded median age since records began in 1962. The lowest recorded median age occurred in 1972 (24.8 years). Between 1972 and 1999 there was a sharp increasing linear trend to a median age of 29.5 years. This statistic has then remained relatively constant (Statistics New Zealand, 2019).

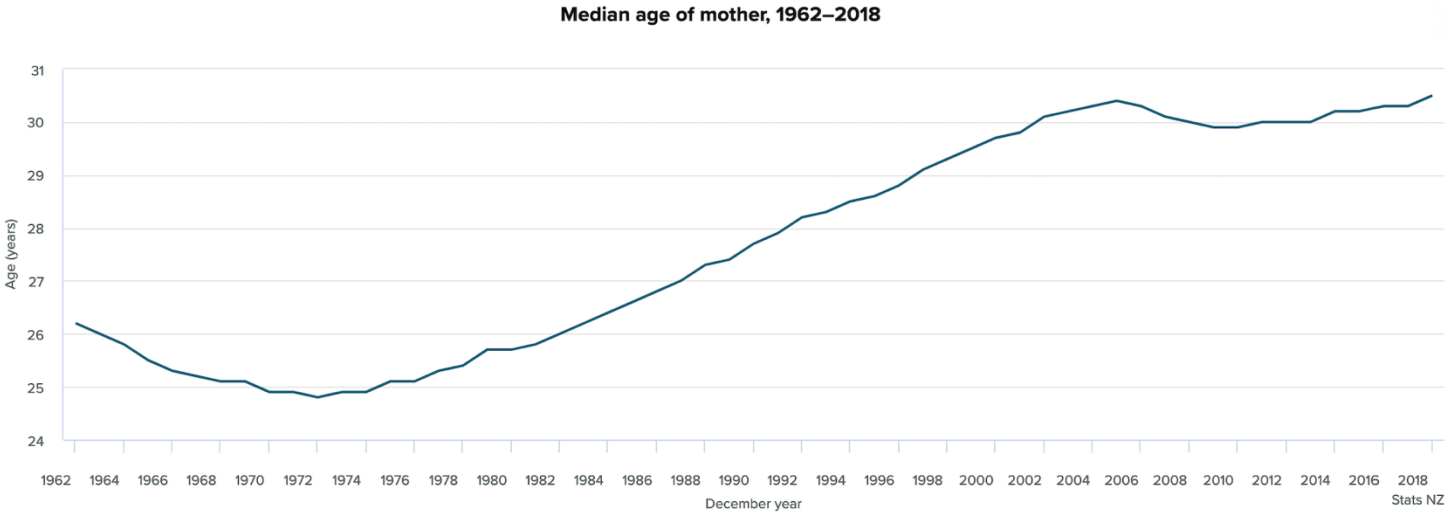

Figure 2.4. NZ median age of child birth between 1962-2018 (Statistics New Zealand, 2019)

2.3. Introducing the New Zealand maternity system

The NZ maternity system is unique compared to other maternity systems worldwide (Grigg & Tracy, 2013). Since 1990, changes in the medical care model have increased care standards and consumer choice. Our current consumer-led maternity system allows women to choose their lead maternity carer (LMC) who follows them through their pregnancy and the first 4-6 weeks postpartum (Bartholomew et al., 2015; Gilkison et al., 2015). An LMC can be a midwife, GP with an approved diploma, or an obstetrician. It is the LMC's role to provide care, education, and guidance from the initiation of pregnancy until women are handed over to a well-child provider at 6 weeks postpartum (Gilkison et al., 2015; Grigg & Tracy, 2013; McAra-Couper et al., 2014).

2.3.1. Breastfeeding in New Zealand

Exclusive breastfeeding is defined as an infant who has only ever taken breastmilk. No other liquids or solids have been given, including water (Ministry of Health, 2006). Full breastfeeding is when an infant has only taken breastmilk in the past 24 hours. Partial breastfeeding is when an infant has taken breastmilk, artificial feed, and/or solid foods (Ministry of Health, 2006).

Breastfeeding supports infants' growth and mental development, visual acuity, and immune function and reduces risk of sudden infant death syndrome, type 2 diabetes, obesity, diarrhoea, asthma, respiratory tract and urinary tract infections (American Academy of Pediatrics, 2005, 2007; J. W. Anderson, Johnstone, & Remley, 1999; Fewtrell, 2004; Gdalevich, Mimouni, & Mimouni, 2001; Gillman et al., 2001; Grummer-Strawn & Mei, 2004; Howie, Forsyth, Ogston, Clark, & Florey, 1990; Raisler, Alexander, & O'campo, 1999). Breastfeeding also benefits women by increasing bonding and reducing the risk of breast and ovarian cancer, postpartum haemorrhage, and financial strain (Arora, McJunkin, Wehrer, & Kuhn, 2000; Britton, Britton, & Gronwaldt, 2006; Newcomb et al., 1994; Rosenblatt & Thomas, 1993).

Breastfeeding is promoted by individual and population strategies in NZ because of the recognised short and long-term benefits (Martis & Stufkens, 2013; Ministry of Health, 2006; Ryan, 1997). LMC's and well-child providers promote, advise, and assist individual women when breastfeeding. Population-based strategies, the baby-friendly hospital and La Leche League initiatives aim to normalise and facilitate supportive environments for breastfeeding (Thornley, Waa, & Ball, 2007). NZ women are also eligible for 52 weeks (22 weeks paid) maternity leave, which allows women to establish breastfeeding. When returning to work employers must provide appropriate facilities and breaks to support breastfeeding (Employment New Zealand, 2018a, 2018b).

2.4. New Zealand breastfeeding statistics

In 2017, almost 80% of NZ babies were exclusively breastfed two weeks after birth (Ministry of Health, 2019). Despite many women initiating, breastfeeding rates decline in the first 6 months postpartum (Table 2.1). Breastfeeding statistics have remained relatively constant since Plunket's records began in 2008 (Plunket, 2019). Breastfeeding is more common in women who are 20-39 years old, European or Indian, residing in less deprived regions, or living in the West Coast District Health Board region (Ministry of Health, 2019).

Table 2.1. Plunket's 2018 breastfeeding statistics (Plunket, 2019)

Breastfeeding style	6 weeks postpartum	3 months postpartum	6 months postpartum
Exclusively/ fully	63%	58%	30%
Partially	23%	20%	39%

2.5. Importance of the diet in pregnancy and lactation

Pregnancy is a life cycle stage that has received extensive scientific interest to ensure the optimal development of the fetus and the continuation of woman's health (Kaiser & Allen, 2008; Lagiou et al., 2004; Ministry of Health, 2006). A key factor identified as a determinant of health outcomes is maternal nutrition (Kaiser & Allen, 2008). The maternal diet has been

shown to influence the duration and quality of pregnancy, physical and mental development of the fetus, ease of delivery, and long-term health outcomes of the woman and fetus (A. S. Anderson, 2001; Gluckman, Hanson, & Pinal, 2005; K. Godfrey, Robinson, Barker, Osmond, & Cox, 1996; K. M. Godfrey & Barker, 2000; Harding, 2001; Kaiser & Allen, 2008; Morton et al., 2014).

In the past thirteen years, there have been a small number of NZ studies that have investigated the dietary choices of women during pregnancy. In 2010, the Growing up in NZ study (GUiNZ) provided important NZ data. This longitudinal study included 6,822 pregnancies from Auckland, Counties Manukau, and Waikato DHB's (Morton et al., 2010). All NZ women who lived within the cohorts three DHB regions with an estimated delivery date between 25 April 2009 and 25 March 2010 were eligible to participate. Women completed a face-to-face computer-assisted personal interview that investigated a variety of topics. Information surrounding food avoidance or addition, information sources, food group consumption, health description, vitamin and supplement use, and alcohol intake during pregnancy was reported (Morton et al., 2010). This study is one of few that is representative of the ethnic diversity and socioeconomic status of NZ families that are having children in NZ. GUiNZ results are therefore broadly generalisable to the NZ population. Dietary choices of women during lactation were not collected in GUiNZ. Prior to GUiNZ, studies conducted in NZ were undertaken in targeted groups and not representative of the population. Watson and McDonald (2009) recruited 196 well educated predominately European pregnant women from the lower North Island. Women completed an eight-day weighed food diary and a food frequency questionnaire (FFQ) at four and seven months of their pregnancy. Macro and micronutrient intakes were reported; however, due to the demographic characteristics of the cohort, the results are not generalisable to all pregnant women in NZ.

Similarly, a woman's dietary intake during lactation is important for the continuation of her health and the health of her infant (Ministry of Health, 2006; Kathleen Maher Rasmussen, 1992). The mother's diet during lactation provides essential nutrients for the process of lactogenesis and maintenance of maternal tissues (Lönnerdal, 1986). There is less evidence about the importance of a woman's diet during lactation for her health than the health of her offspring (Picciano, 2003). This is likely a result of the primary focus of lactation being the

growth and development of the infant (Kominiarek & Rajan, 2016; Picciano, 2003). Milk production and composition are largely unaffected by a woman's diet and nutritional status, with the exception for some micronutrients including vitamin A, iodine, thiamine, riboflavin, pyridoxine, and cobalamin (Allen, 2005; Segura, Ansótegui, & Díaz-Gómez, 2016). When maternal nutrition status is compromised lactogenesis will take priority at a woman's expense (Butte, Garza, Stuff, Smith, & Nichols, 1984; Kent, 2007). Previous studies that have investigated the diet during lactation have predominately occurred in developing countries or in immigrant populations (Higginbottom, Vallianatos, Shankar, Safipour, & Davey, 2018; Joshi & Kulshrestha, 2018). There is the potential for these cohorts to have strict cultural practices which may explain the emphasis in the findings on how cultural beliefs affect food choice (Jeong, Park, Lee, Ko, & Shin, 2017). Currently, there is very little evidence on women's dietary choices during lactation and the factors which influence these choices, particularly in developed countries.

2.5.1. Nutritional requirements in pregnancy and lactation

Nutritional requirements during pregnancy and lactation differ from other life stages (Ministry of Health, 2006). Predominately nutrient requirements increase compared to other life cycle stages, however, there is a reduced need for iron during lactation (Ministry of Health, 2006). During pregnancy, fetal development additional to the continual maintenance of maternal tissues increases a woman's nutritional requirements (King, 2000). In lactation nutrient requirements remain high to support milk production, allowing infants to double their birth size in the first 4-6 months of life (Picciano, 2003). Nutrients of particular importance are energy, iodine, folate, iron (in pregnancy), vitamin D, and calcium (Ministry of Health, 2006).

Macro and micronutrient requirements

Macronutrient requirements differ depending on the stage of pregnancy and a woman's nutritional status, however, women generally have increased requirements for energy, protein, fat, and fibre in pregnancy and lactation (Australian Government and Ministry of Health, 2006; Ministry of Health, 2006).

Increased requirements for micronutrients, folate and iodine, are often not met by a general healthy diet (Allen, 2005; Black et al., 2008; Blumfield, Hure, Macdonald-Wicks, Smith, & Collins, 2013). Folate requirements increase during pregnancy because of increased cell division. Folate deficiencies can result in neural tube defects, other congenital abnormalities, and/or a low birth weight of the infant. Additionally, women have an increased risk of pre-eclampsia, pre-term delivery, placental abruption, and spontaneous pregnancy loss (Holmes, 2003; Vollset et al., 2000). Women are recommended to take folic acid supplements four weeks prior to conception and during the first 12 weeks of pregnancy to avoid deficiency (Ministry of Health, 2006). Iodine deficiency is common in NZ, due to low levels of iodine found in our soils (Brough et al., 2015). Iodine requirements increase by approximately 50% in pregnancy and lactation because of infants high growth requirements (Azizi & Smyth, 2009; Ministry of Health, 2006; Zimmermann & Andersson, 2012). Inadequate supply of iodine can result in thyroid dysfunction of mother and infant, abortion, preterm delivery, stillbirths, dwarfism, cretinism, mental retardation, and delays in infant development (Azizi & Smyth, 2009; Ministry of Health, 2006). Supplementation for pregnant and breastfeeding NZ women was introduced in 2010, alongside the population initiative of bread fortification (Ministry of Health, 2010; Schiess, Cressey, & Thomson, 2012). Folic acid supplement recommendations are incorporated into the current guidelines however recommendations for iodine are not. Iodine supplementation during pregnancy and lactation was recommended by the Ministry of Health in 2010 after the current guidelines were published in 2006 and the most recent update in 2008.

Women's iron requirements increase in pregnancy because of fetal demand and maternal blood volume expansion (Fisher & Nemeth, 2017). In some cases, iron supplements are required (Bothwell, 2000). Iron requirements in lactation are lower than an average adult female between 19-50 years of age because of lactational amenorrhea (temporary cessation of menstruation) (Australian Government and Ministry of Health, 2006; Picciano, 2003). Iron deficiency can result in fatigue, poor concentration, and increased risk of infection (Allen, 2000; Scholl & Reilly, 2000). If iron deficiency results in anaemia, low iron stores and haemoglobin, women have an increased risk of postpartum haemorrhage, infection, heart failure, and mortality (Scholl & Reilly, 2000). Infants may also experience non-reversible effects on cognition, behaviour, motor development, and physical capacity (Scholl & Reilly,

2000). Severe deficiency can cause fetal death, pre-term delivery, and lower birth weight (Scholl & Reilly, 2000). Increased iron requirements and the adverse outcomes of deficiency provide rational why NZPBG have an emphasis on iron-rich foods and why iron status is continually monitored during pregnancy.

Dietary calcium is important to support women's increased calcium requirements during pregnancy and lactation. Requirements are partially shielded by pregnancy-induced physiological changes in bone turnover and absorption (C. S. Kovacs, 2001; Laskey et al., 1998; Ministry of Health, 2006; Sowers, 1996). Women commonly lose bone density during pregnancy and lactation but return to pre-pregnancy levels once breastfeeding has ended (C. S. Kovacs, 2001). There are however exceptions for adolescents, multiple fetuses, short interpregnancy gap, or those undergoing heparin treatment (Oliveri, Parisi, Zeni, & Mautalen, 2004). In the cases of very low calcium diets, there is a lack of consensus of the long-term consequences (Chowdhury et al., 2015). There is limited evidence suggesting that bone density is affected in later life and how a low calcium diet affects long-term maternal health (Affinito, Tommaselli, Guida, & Nappi, 1996; C. S. Kovacs, 2001; Lopez, Gonzalez, Reyes, Campino, & Diaz, 1996; Ministry of Health, 2006).

2.5.2. Inadequate nutrition in pregnancy

Undernutrition during pregnancy

Undernutrition before and during pregnancy has detrimental effects on fetal development (Butte, Ellis, Wong, Hopkinson, & Smith, 2003; Ehrenberg, Dierker, Milluzzi, & Mercer, 2003; Fall, 2009; T. Roseboom, de Rooij, & Painter, 2006). Depending on the stage of gestation undernutrition can have different effects, as observed following the Dutch famine in World War II (T. Roseboom et al., 2006).

At all stages of gestation, undernutrition predicted impaired glucose tolerance and low birth weight predisposing infants to developing type 2 diabetes, cardiovascular disease, metabolic syndrome, osteoporosis, lung disease, and mental health complications in later life (David J Barker et al., 1991; David JP Barker, Osmond, Winter, Margetts, & Simmonds, 1989; Cooper et al., 2006; Fall, 2009; Ramadhani et al., 2006; Victora et al., 2008). Undernutrition is also

associated with spontaneous preterm birth and irreversible growth retardation (Black et al., 2008; Tucker & McGuire, 2004). Unlike low birth weight and impaired glucose tolerance that were associated with undernutrition during any stage of gestation, the risk for other diseases were associated with specific gestational stages (De Rooij et al., 2006; A. C. Ravelli et al., 1998). Early gestation undernutrition increased infants' risk of developing coronary heart disease, atherogenic lipid profile, reduced blood coagulation, heightened response to stress, and/or obesity in later life (Hoet & Hanson, 1999; Painter et al., 2006; Painter et al., 2005; G.-P. Ravelli, Stein, & Susser, 1976; T. J. Roseboom, van der Meulen, Osmond, Barker, Ravelli, & Bleker, 2000; T. J. Roseboom, van der Meulen, Osmond, Barker, Ravelli, Schroeder-Tanka, et al., 2000). Undernutrition in late gestation was predictive of mortality, high blood pressure, schizophrenia, congenital neural defects, and infant personality disorders in later life (Hoek, Susser, Buck, & Lumey, 1996; Neugebauer, Hoek, & Susser, 1999; Painter et al., 2005; G.-P. Ravelli et al., 1976; T. J. Roseboom et al., 1999).

Key micronutrient deficiencies during pregnancy

In developed countries, including NZ, undernutrition is predominately micronutrient malnutrition (Blumfield et al., 2013; Popkin, 2006). Deficiencies in folate, pyridoxine (B6), riboflavin (B2), thiamine (B1), iron, vitamin D, calcium, selenium, vitamin A, and zinc have been identified in NZ women during pregnancy in various NZ studies (Benny, Benny, & Sin, 1991; McKenzie-Parnell, Wilson, Parnell, Spears, & Robinson, 1993).

Vitamin D and iron deficiency are the most frequently reported micronutrient deficiencies (Calje & Skinner, 2017; Eagleton & Judkins, 2006; Ekeroma et al., 2015; Morton et al., 2010; Parnell, Wilson, Thomson, Mackay, & Stefanogiannis, 2011; Wheeler et al., 2018). In 2006, 87% of surveyed Wellington pregnant women (n=90) were vitamin D deficient (Eagleton & Judkins, 2006). This study, however, was not representative of the NZ population as the majority of women included were migrants. Additionally, the sample size was very small. In 2008/09, the national nutrition survey found that over one-third of women of childbearing age (15-44 years) had inadequate vitamin D levels (Parnell et al., 2011). Women who had darker skin, avoided sun exposure, had kidney/liver disease, took medications that affect vitamin D levels (e.g. anticonvulsants), of childbearing age, and/or lived in southern regions had an increased risk of vitamin D deficiency. Subsequently in 2013 48% of Dunedin women

(n=80) were vitamin D deficient during their pregnancy (Wheeler et al., 2018). This study was however conducted in the Southern region of NZ in a cohort of predominately European women which may have impacted the results. In a multiethnic cohort from South Auckland (n=259) 42% of women were vitamin D deficient (Ekeroma et al., 2015). In 2013, in a study that investigated Canterbury midwives iron deficiency management reported varying levels of iron deficiency during the first (9.5%), second (74%), and third (47%) trimester of women's (n=189) pregnancies (Calje & Skinner, 2017). There were however discrepancies in how many women were tested and the methods of testing which may have impacted results. Latterly in GUiNZ, 4.3% of women had iron-deficiency-anaemia prior to and during pregnancy and 4.7% developed iron-deficiency-anaemia during their pregnancy (Morton et al., 2010). Deficiencies in vitamin D and iron are preventable by regular screening and the consumption of a balanced diet as recommended by NZPBG (Ministry of Health, 2006).

In other developed countries vitamin D, folate, and iron deficiencies are also prevalent. It has been suggested that this is likely because women are not meeting dietary and lifestyle recommendations (Blumfield et al., 2013; Dawodu & Wagner, 2007; Parnell et al., 2011).

Nutrient intake and weight gain

Weight gain during pregnancy is a normal physiological process that occurs due to fetal growth, placental development, breast enlargement, and blood plasma expansion (Herring, Rose, Skouteris, & Oken, 2012; Kathleen M Rasmussen, Catalano, & Yaktine, 2009). Weight gain recommendations differ depending on a woman's pre-pregnancy body mass index (BMI) (Table 2.2). Excessive weight gain or pre-pregnancy obesity is not part of a normal pregnancy and predisposes complications (Guelinckx, Devlieger, Beckers, & Vansant, 2008; Herring et al., 2012; Merkx, Ausems, Budé, de Vries, & Nieuwenhuijze, 2015; Ministry of Health, 2014).

Table 2.2. Recommended total weight gain during pregnancy (National Research Council, 2010)

Pre pregnancy (BMI kg/m^2)	Recommended weight gain (Kg)
Underweight (<18.5)	12.5-18
Normal BMI (18.5-24.9)	11.5-16
Overweight (25.0-29.9)	7-11.5
Obese BMI (>30)	5-9

Note: adolescents should aim for upper end and short women (<1.57m) should aim for lower end of their recommended range.

Obesity during pregnancy

In the 2008/09 National nutrition survey, 30% of reproductive age women were classified as obese with a BMI >30kg/m^2 (Parnell et al., 2011). This is similar to other developed countries where the rate of obesity in women of reproductive age is increasing (Ramachenderan, Bradford, & Mclean, 2008). Because of limited evidence, the NZPBG only covers basic recommendations such as the importance of weight loss prior to conception, obtaining nutrition counselling, early gestational diabetes mellitus (GDM) screening, and limiting pregnancy weight gain to 6kg or less (Ministry of Health, 2006).

Obesity during pregnancy has been associated with pregnancy and postpartum complications including GDM, pre-eclampsia, gestational hypertension, depression, surgical/ instrumental birth intervention, postpartum overweight/ obesity, blood loss (>500mL), and urinary tract, uterine, and wound infections (Bianco et al., 1998; Dodd, Grivell, Nguyen, Chan, & Robinson, 2011; Florence Galtier-Dereure, Boegner, & Bringer, 2000; F Galtier-Dereure, Montpeyroux, Boulot, Bringer, & Jaffiol, 1995; Linne, 2004; Marchi, Berg, Dencker, Olander, & Begley, 2015; Ministry of Health, 2014; Perlow, Morgan, Montgomery, Towers, & Porto, 1992). Additionally, offspring have an increased risk of preterm birth, macrosomia, physiological defects, congenital deformities, perinatal death, and requiring intensive medical care after birth (Abenhaim, Kinch, Morin, Benjamin, & Usher, 2007; Kiran, Hemmadi, Bethel, & Evans, 2005).

2.5.3. Inadequate nutrition during lactation

To date, limited research has been conducted investigating maternal undernutrition during lactation (Picciano, 2003). Most research has investigated the nutritional intake of the infant during lactation (Abou-Dakn, 2018). Milk composition is largely unaffected by a woman's nutritional status, however, when women are malnourished the supply of vitamin A, iodine, thiamine, riboflavin, pyridoxine, and cobalamin may decline, affecting both the women and infant (Allen, 2005; Segura et al., 2016). Maternal malnutrition increases a woman's risk of anaemia, immunodeficiency, low energy, and prolonged amenorrhea (Black et al., 2008; Kennedy, 1994; Mahan & Raymond, 2016; Udipi, Ghugre, & Antony, 2000).

Postpartum weight loss

Weight loss is commonly observed in the postpartum period (Butte et al., 2003). Weight loss is highly variable and can be a result of increased energy requirements during lactation, physical exercise, and/or dietary restrictions (Ministry of Health, 2006). Dieting while breastfeeding before 9-12 months postpartum is not advised (Ministry of Health, 2006). Trends and the effect of dieting during lactation have not yet been identified in NZ, however, it is known that women frequently want to lose weight gained during pregnancy (Lovelady, Stephenson, Kuppler, & Williams, 2006; Rössner & Öhlin, 1995).

Obesity and breastfeeding

There is some evidence suggesting obese women are less likely to breastfeed or breastfeed for shorter durations because of delayed lactation onset, embarrassment, difficulty breastfeeding, and medical complications (caesarean sections, diabetes, and thyroid dysfunction) (Kominiarek & Rajan, 2016; Wojcicki, 2011). This is, however, an understudied area, which requires further research before conclusions can be made about the effect that body size has on breastfeeding and health outcomes.

2.6. Pregnancy and lactation guidelines in New Zealand

NZPBG were published in April 2006 by the NZ Ministry of Health (Ministry of Health, 2006). They have since been updated in 2008 and are currently being revised to align with the new

eating and activity guidelines (Ministry of Health, 2015a). The guidelines are a comprehensive explanation of the nutrient reference values (NRV) and recommended food safety practices. Recommendations are made for daily servings of foods from the four food groups: 1. Fruit and vegetables, 2. Bread and cereals, 3. Milk and milk products, 4. Meat/ meat alternatives/eggs (Table 1.1).

The NZPBG were developed alongside a series of nutritional background papers for various lifecycle stages (Ministry of Health, 2006; National Health and Medical Research Council, 2006). The nutritional guidelines aim to provide health professionals with up-to-date evidence-based recommendations to support optimal health for women and their offspring. These guidelines also provide key nutrition messages which are communicated to women via educational resources.

During pregnancy and lactation, women are recommended to add or increase, limit, and remove different foods and beverages (Ministry of Health, 2006; Ministry of Primary Industries, 2019). Recommendations about adding or increasing foods in the diet are designed to increase women's energy, macronutrient, and micronutrient intake (Ministry of Health, 2006, 2013a). Most foods recommended to be avoided are high-risk for foodborne illness (Ministry of Health, 2006; Ministry of Primary Industries, 2019). Others, such as alcohol, are known to be teratogenic to the offspring (Ministry of Health, 2006; Sokol, Delaney-Black, & Nordstrom, 2003). Foods and beverages recommended to be limited generally contain high amounts of caffeine (>600mg), mercury, cadmium, and vitamin A, which have been associated with a reduction of fetal birth weight (caffeine and cadmium), spontaneous abortion, toxaemia, anaemia (cadmium), birth defects (vitamin A) and toxicity complications in the infant's brain and nervous system (mercury) (Azaïs-Braesco & Pascal, 2000; Bracken, Triche, Belanger, Hellenbrand, & Leaderer, 2003; Dorea, 2004; Huel, Boudene, & Ibrahim, 1981; Nishijo et al., 2002).

2.6.1. Food and nutrition recommendations during pregnancy

Recommendations for food consumption during pregnancy are more specific than during lactation. According to Ministry of Health (2006), women are recommended to:

1. Add or increase low-fat dairy products, whole-grain bread and cereals, fruit, vegetables, and meat/meat alternatives/eggs (Table 1.1)
2. Limit coffee, energy drinks/ shots, chocolate, cola soft drinks (caffeine), and various fish species (mercury), and oysters (cadmium)
3. Avoid alcohol, unpasteurised dairy products, raw egg, raw or cold cooked meats, raw fish and shellfish, soft-serve ice cream, ready-made salads, hummus, and tahini

2.6.2. Food and nutrition recommendations during lactation

In NZ women are recommended to exclusively breastfeed for the first six months (Ministry of Health, 2006). When women are unable to breastfeed or choose not to, formula feeding or partial breastfeeding is advised. Around six months the initiation of complementary feeding additional to breast and/or formula feeding is recommended to support infants increased nutritional requirements (Ministry of Health, 2006). Breastfeeding should be continued until at least 12 months of age (Ministry of Health, 2006, 2008; World Health Organization, 2002).

Dietary recommendations are more relaxed during lactation. Women are recommended to consume a wide range of food from the four food groups (Table 1.1). This includes many foods that were recommended to be avoided during pregnancy for food safety reasons. Guidelines suggest women continue eating an extra serving of vegetables, milk and milk products, and protein foods and add an additional serving of grains (Table 1.1). Foods and beverages suggested to limit include alcohol and caffeine, as they are transferred into breastmilk and can cause infant symptoms (Ministry of Health, 2006; Sachs, 2013).

2.7. Women's dietary choices during pregnancy

In 2010, GUiNZ provided evidence of women's dietary choices in pregnancy (Morton et al., 2010). In GUiNZ 90% of women altered their diet during pregnancy. Despite a high rate of dietary alterations, only 3% of women met all NZPBG food group recommendations (Morton et al., 2014). One in four women did not meet any food group recommendations.

Recommendations were met by 25% (fruit and vegetables), 26% (bread and cereals), 58% (milk and milk products), and 21% (meat/ meat alternatives/ eggs) of women. These results were similar to observations of 870 women residing in the lower North Island between 1995-1996 (Mitchell et al., 2004). In the final month of pregnancy, recommendations were met by 53% (fruit and vegetables), 56% (milk and milk products), and 93% (meat/ meat alternatives/ eggs) of women. This study was not representative of the NZ population group and included a significant number of European women, which may have impacted results.

There are mixed results between other developed countries for the number of women meeting dietary recommendations. Blumfield et al. (2011) recruited a cohort of 606 well educated pregnant women in Australia and showed similar results to GUiNZ with recommendations being met by 14% (bread and cereals), 55% (fruit), 11% (vegetables), and 50% (milk and milk products) of women. However, more women met recommendations for meat/ meat alternatives/ eggs (82%). This may have occurred because of the cohort's well-educated status. Another Australian study conducted in 2014 showed similar results with nearly two-thirds of women meeting fruit and vegetable consumption (Smedley et al., 2014). This study was however small (n=119) and included a large proportion of well-educated women. Wen, Flood, Simpson, Rissel, and Baur (2010) recruited a cohort of 409 Australian primiparous pregnant women and obtained very different results. Vegetable and fruit recommendations were met by 7% and 13% of women respectively. The population group, however, included a large number of women of lower socioeconomic status, which may have been the reason why only a small number of women met recommendations (Darmon & Drewnowski, 2008; Morton et al., 2014; Northstone, Emmett, & Rogers, 2008). A year prior, fruit and vegetable recommendations were more frequently met (64%) by 1490 British women (Crozier et al., 2009). This difference could have been because of differences in fruit and vegetable intake in the general population.

Currently there is a mixture of evidence, particularly for fruit and vegetable intake, to suggest if women are meeting food group recommendations (Hillier & Olander, 2017). This suggests that further investigation of women's dietary choices during pregnancy is needed to understand women's dietary choices. Identifying what recommendations are not being met could justify the implementation of future nutritional strategies.

2.7.1. Food and beverage removal and addition during pregnancy

Foods and beverage removal during pregnancy

The most common dietary changes in GUiNZ were related to alcohol, caffeine, and raw or highly processed foods (Morton et al., 2010). Women (87%) avoided food and/or beverages including alcohol (65%), caffeinated beverages (38%), raw and processed seafood (47%), stored salads and coleslaws (33%), processed/ deli meat and products (33%), soft cheeses (31%), and carbonated drinks (19%). This was similar to previous trends observed in Belgium where women (n=148) were likely to make dietary changes because of pregnancy-related risks, often avoiding raw vegetables (16%), meat (85%), fish (93%), shellfish (81%), cheese (57%), eggs (40%), ready-to-eat meals (60%), processed meat products (38%), and alcohol (28%) (Verbeke & De Bourdeaudhuij, 2007). Recently a cohort of Canadian women (n=379) reported making changes to beverages and high-risk foods in their diet, including decreasing caffeine intake (77%), eliminating alcohol (53%), and following food safety recommendations (removal of soft cheese, raw fish or sushi, undercooked meat, unpasteurised milk products, and raw or undercooked eggs) (53%) (Forbes et al., 2018). Studies from other developed countries have also observed a decrease in alcohol, egg, fast food, meat and alternatives, coffee, and tea consumption when comparing women's diets between pre-conception and pregnancy (Ådén, Johansson, & Håglin, 2007; Crozier et al., 2009; Forbes et al., 2018; Pinto, Barros, & dos Santos Silva, 2009; Skreden, Bere, Sagedal, Vistad, & Øverby, 2015).

Food addition during pregnancy

In GUiNZ approximately 40% of women added foods to their diet (Morton et al., 2010). Most commonly fruit and vegetables (49%), beverages (43%), milk and milk products (39%), and protein-rich foods (25%) were added. These results share similarities with other studies. Verbeke and De Bourdeaudhuij (2007) identified pregnant women from Belgium consumed significantly more beef, milk and milk products, and fruit than non-pregnant women. Canadian women either increased or added vegetables and fruit (40%), grain products (27%), milk and alternatives (49%), and/or meat and alternatives (21%) to their diet (Forbes et al., 2018). Other studies have shown that women frequently add "beneficial" foods to their diet, in particular, dairy products, fruit, and vegetables (Blumfield et al., 2011; Olson, 2005). There

is less reported evidence about women's intake of milk and milk products, meat, and grain food (Hillier & Olander, 2017). From what is known, there are mixed results for milk and milk consumption. Crozier et al. (2009), Pinto et al. (2009), and Olson (2005) suggest that women increase their consumption of milk and milk products in pregnancy, however, Smedley et al. (2014) found no change in dairy consumption. Differences between collecting data on milk or dairy products could have influenced the differences between these studies. Results for meat and grain consumption widely differ and no clear trends have been observed (Crozier et al., 2009; Pinto et al., 2009).

Maintaining good nutrition during pregnancy is important but may be more difficult for women when commonly eaten foods need to be either removed or limited. There is the potential for women to also remove foods completely rather than limiting them to meet current guidelines.

2.7.2. Factors influencing dietary choices during pregnancy

Women are often described as being highly motivated and amenable to change during pregnancy (Phelan, 2010; Szwajcer, Hiddink, Maas, Koelen, & Van Woerkum, 2008). It has been commonly observed that changes in dietary choices reflect a woman's pregnancy-related symptoms, level of education, nutrition knowledge, food importance, financial stability, cultural preferences and traditions, motivation, parity number, and dietary choices prior to conception (Bayley, Dye, Jones, DeBono, & Hill, 2002; Bianchi et al., 2016; Coronios-Vargas et al., 1992; Fowles & Fowles, 2008; Hurley et al., 2005; Jasti et al., 2003; Morton et al., 2014; Paterson, Hay-Smith, & Treharne, 2016; Szwajcer et al., 2007; Watson & McDonald, 2009).

In GUiNZ the main factors influencing dietary choices included Pacific or Asian ethnicity, younger age, income below $20,000, and or those with other children (Morton et al., 2014). These women were less likely to meet food group recommendations. In 2003, major influences of nutrient intake of 196 pregnant NZ women were years of education (8.5%), age (4.3%), welfare dependence (4.3%), smoking (3.4%), and the severity of morning sickness (2.3%) (Watson & McDonald, 2009). Poorer diets were observed in women who experienced

one or more of these influences. This study, however, does not represent the general NZ population as women included were predominantly European and of high socioeconomic status and education. Previous work completed by Watson and Macdonald also suggests that seasonality affects women's nutrient intake during pregnancy in NZ (n= 197) (Watson & McDonald, 2007).

In other developed countries similar influences, particularly education and socioeconomic status, have been reported (Kramer, Seguin, Lydon, & Goulet, 2000). In Austria (n=261) and America (n=52) education, income, age, and socioeconomic status were found to affect women's dietary choices (Aaronson, Mural, & Pfoutz, 1988; Freisling et al., 2006). Forbes et al. (2018) identified different influences that affected Canadian women's dietary choices. Concerns about the health of their baby, food safety concerns, aversions, and nausea commonly caused women to reduce alcohol, coffee, tea, raw fish, undercooked and/or red meat, and vegetables. Factors such as cravings, the nutritional content of foods, health, enjoyment, and to decrease illness risk caused women to add or increase foods such as fruit, milk and milk products, vegetables, sweet foods, starches, and soda (Forbes et al., 2018).

It's important for health professionals to be aware of and consider factors which influence women during pregnancy. There may be groups of women who are less likely to adhere to recommendations in NZ, including those of Pacific or Asian ethnicity, younger age, lower-income and education, and/ or those with other children (Morton et al., 2014). Understanding the factors which influence women would allow health professionals to plan and implement effective education strategies to improve diets during pregnancy and lactation.

2.7.3. Supplement use during pregnancy

Women are recommended to take folic acid supplements 4 weeks prior to conception until the first 12 weeks of pregnancy to meet increased folate requirements (Ministry of Health, 2006; Teixeira et al., 2018). This recommendation is frequently not met by NZ women due to approximately 50% of pregnancies being unplanned (Hohmann-Marriott, 2018; Morton et al., 2010). In GUiNZ, 58% of NZ women with planned pregnancies took folic acid before

conception, 34% added folic acid during pregnancy, and 8% did not take folic acid at any stage (Morton et al., 2010). Of unplanned pregnancies 9% took folic acid before conception, 28% did not take any folic acid, and 63% took folic acid during pregnancy. Worldwide it is estimated that fewer than 50% of women take folic acid supplements (Ray, Singh, & Burrows, 2004; Stockley & Lund, 2008). Women of Māori, Pacific, Asian, and Middle Eastern/ Latin American/ African ethnicity, unplanned pregnancies, low education, and low socioeconomic status are more likely not to take folic acid supplements (Branum, Bailey, & Singer, 2013; Hernandez-Diaz, Werler, Louik, & Mitchell, 2005; Morton, Grant, & Atatoa Carr, 2013; Sen, Manzoor, Deviasumathy, & Newton, 2001; Van Eijsden, Van Der Wal, & Bonsel, 2006).

Iodine supplementation for pregnant and breastfeeding NZ women was introduced in 2010 (Ministry of Health, 2010; Schiess et al., 2012). In 2010, (n=127) 70% of pregnant and 36% of breastfeeding NZ women took supplements containing iodine (Brough et al., 2015). It was however noted that some women were taking supplements that contained less than the amount recommended. The poor adherence to guidelines on iodine supplementation in lactation may have occurred due to ineffective communication to women about recommendation changes. However, as this study was conducted soon after recommendations changed supplement use has likely changed.

Other supplements that women may take include iron and vitamin/minerals (Ministry of Health, 2006; Morton et al., 2010). NZ women with planned pregnancies are more likely to take supplements prior to conception than unplanned pregnancies. In 2010, 30% of women with planned pregnancies took iron and 41% took vitamin supplements prior to conception (Morton et al., 2010). This was higher than the 11% and 13% of women with unplanned pregnancies who took iron and vitamin supplements. Women with unplanned pregnancies (52%) were more likely to take iron supplements during pregnancy than planned pregnancies (45%). There was no difference in vitamin intake during pregnancy between planned and unplanned pregnancies.

Worldwide data follows similar trends. In a 2002 study, (n=211) 62% of Australian women took supplements during pregnancy, including 70% folic acid supplements, 38% iron, and 27% vitamin/ mineral supplements (Maats & Crowther, 2002). An American study (n= 1296)

showed similar results, with 77% of women taking supplements during pregnancy, most commonly multivitamins containing both folate and iron (Branum et al., 2013). Similar to folic acid supplements, women who are of lower education, younger, of lower socioeconomic status, particular ethnicity, within early pregnancy, and/or experiencing an unplanned pregnancy are less likely to use supplements (Branum et al., 2013; Jasti et al., 2003; Sullivan, Ford, Azrak, & Mokdad, 2009).

Although women are recommended to take folic acid and iodine supplements during pregnancy previous studies have reported limited adherence to the current guidelines (Brough et al., 2015; Morton et al., 2010). Evidence for iodine use is, however, outdated and likely to have changed. Limited adherence could be because of unplanned pregnancies, health inequality, or ineffective communication.

2.8. Women's dietary choices during lactation

There is less evidence available worldwide about women's dietary choices during lactation. Additionally, the majority of studies have investigated the maternal diet's effect on breastmilk composition or infant symptoms. Small previous NZ studies suggest that energy, dairy, and vegetable recommendations are not met (Butts et al., 2018; Todd and Parnell, 1994; Todd & Parnell, 1995). Recently Butts et al. (2018) identified NZ women's (n=78) dietary intake through 3-day food diaries and reported food group servings by ethnicity. On average Asian women consumed more fruit (3 servings) and whole grains (3 servings); NZ Europeans consumed more dairy (2 servings), and meat and fish (2 servings); and Māori/ Pacific island women consumed more vegetables (3 servings). When comparing women's daily servings to the NZPBG, recommendations for vegetables, whole grains, and dairy were met by none of the groups, fruit was met by all, and meat and alternatives were met by all except Asian. This agrees with previous results identified by Todd and Parnell (1995), where women did not meet dairy recommendations.

Contrasting results have been observed worldwide. Olson (2005) identified that dairy (>2 servings) and fruit and vegetable (>3 servings) consumption declined between pregnancy and

1 year postpartum, with the largest decline occurring in the first 6 months. On average, recommendations for dairy (70%) were met by more women than fruit and vegetables (65%). In 149 American women grain, vegetable, and fruit consumption decreased in the postpartum period (George, Hanss-Nuss, Milani, & Freeland-Graves, 2005). This study, however, acknowledged that women's low incomes could have influenced this decline. In Fowles and Walker (2006) study (n=100) 44% of women were categorised as not meeting Food Guide Pyramid recommendations. Recommendations were met by 14% (bread), 24% (vegetables), 51% (fruit), 66% (dairy), and 79% (meat). Again this study had large limitations including small sample size and lack of variability in ethnicity and income, which may have impacted results.

From the limited research that has been conducted it seems that dietary recommendations are frequently not met in lactation, particularly for vegetables, grains, and dairy. These food groups are also commonly avoided by young children, which could be correlated following recent evidence finding an association between the quality of the maternal diet and the infant/child's diet (Bjerregaard, Halldorsson, Tetens, & Olsen, 2017). Further research, particularly in NZ, is required to determine what recommendations are not being met during pregnancy and lactation and possible reasons for this.

2.8.1. Factors influencing food addition and removal during lactation

Similar to pregnancy there are many influences that potentially affect women's dietary choices during lactation including age, ethnicity, religion, income, education, marital status, lifestyle, number of previous children, employment status, breastfeeding status, infant symptoms, and food price (Fowles & Walker, 2006; Kulakac, Oncel, Meydanlioglu, & Muslu, 2007; Morton et al., 2012).

Methods to increase milk production and infant symptoms are two of the most commonly reported influences. From 135 questionnaire results from Turkish postpartum women, 100% made dietary changes during lactation (Kulakac et al., 2007). The most common changes to increase milk production were increasing fluids (39%), sweets (25%), and dairy products (20%). Korean women (n=145) also made dietary changes to increase milk production (Jeong

et al., 2017). Women believed increasing their consumption of water, seaweed, warm foods, soup, soymilk, Jokbal (Korean pig trotters), carp, and milk improved milk production and Sikhye (Korean rice beverage), pumpkin, and fatty food inhibited production. It is likely that these dietary changes were affected by culture and would be different to changes observed in NZ. Infant related symptoms may also influence dietary choices during lactation. Todd and Parnell (1995) identified that dairy avoidance in Dunedin women was often related to concerns about infant allergies. Other studies have also found similar findings, with women removing dairy products because of concerns about infant colic (Jeong et al., 2017; Kidd, Hnatiuk, Barber, Woolgar, & Mackay, 2019). Other foods avoided in these studies to reduce infant colic include "gassy vegetables" (cabbage, cauliflower, and broccoli), fruit, acidic foods, spicy foods/strong flavours (garlic, chilli), onions, beans, carbonated beverages, eggs, legumes, grains and cold foods (Jeong et al., 2017; Joshi & Kulshrestha, 2018; Kidd et al., 2019; Kulakac et al., 2007). Currently, evidence suggests, with the exception of maternal avoidance of cow's milk for infants with a cow's milk allergy, that no maternal dietary interventions reduce infantile colic (Hill et al., 2005; Kidd et al., 2019).

The avoidance of caffeine, tea, cold foods, curd/buttermilk, spicy food, nuts, and alcohol are also commonly reported for a variety of reasons including reducing the risk of allergies or illness, concerns, and following recommendations (Gordon et al., 2018; Jeong et al., 2017; Kulakac et al., 2007). When women believe their diet does not influence baby symptoms they are more likely to add foods such as milk (for calcium) or avocados and salmon (for healthy fats) (Kidd et al., 2019). Considering the results from worldwide studies there is a large amount of confusion about how the maternal diet affects an infant and breastmilk supply, which may suggest why women frequently report removing foods from the diet. Currently, it is unknown if these trends are occurring in NZ.

2.8.2. Supplement use during lactation

Currently, the only recommended supplement for all women during lactation in NZ is iodine (Ministry of Health, 2006, 2010). The guidelines, however, do recommend that supplements may be required for women who consume diets such as vegetarian or vegan that increase the risk of nutrient deficiencies (Ministry of Health, 2006). Despite there only being

recommendations for iodine, the use of vitamins, minerals, and alternative medicines during lactation is common (Lee, Binns, Zhao, Scott, & Oddy, 2011; Picciano & McGuire, 2008; Sim, Sherriff, Hattingh, Parsons, & Tee, 2013; Zheng et al., 2019).

Previous studies worldwide have reported varying levels of supplement use. These levels, however, remain lower than supplement use during pregnancy (Cogswell, Kettel-Khan, & Ramakrishnan, 2003; Picciano & McGuire, 2008). In a small NZ study (n=78) 60% of women reported taking supplements during lactation (Butts et al., 2018). Most commonly multivitamins, iron, and iodine were taken. This study's ethnic diversity was similar to what is observed in the NZ population group, however, only women from the Manawatu-Whanganui region were included. In Australia, two studies have identified supplement use in the postpartum period. Lee et al. (2011) found that 36% of Perth women (n=587) took vitamin supplements a year postpartum. Sim et al. (2013) also investigated women living in Perth (n=304). They, however, found a higher number of women took herbal supplements. This higher use could have been because of differences in methodology, which potentially introduced biased results. Supplement use identified in America (n=45) and the Netherlands (n=587) showed large differences with 73% and 41% of women reporting use respectively. The most common supplements reported include multivitamins/ multimineral, folic acid, iron, and calcium (Lee et al., 2011; Picciano & McGuire, 2008; Schirm, Schwagermann, Tobi, & de Jong-van den Berg, 2004; Stultz, Stokes, Shaffer, Paul, & Berlin, 2007). Additionally, alternative medicines (garlic, fenugreek, ginger, and chamomile) have been reported because of their believed ability to stimulate milk production (Barennes et al., 2009; Lee et al., 2011).

Factors influencing supplement use include ethnicity, cultural practices, income, level of education, advice from family and friends, internet, GP's, and pharmacists (Budzynska, Gardner, Duguoa, Dog, & Gardiner, 2012; Butts et al., 2018; Cogswell et al., 2003; Picciano & McGuire, 2008; Sim et al., 2013). Despite there only being one supplement recommendation during lactation in NZ, previous worldwide studies have identified a variety of supplements that women use. This could be due to different recommendations in the countries that the studies took place or because of the different population groups that were recruited. Further research is needed in NZ to distinguish supplement use, particularly for iodine to ensure the latest recommendations are being communicated to women.

2.9. Food safety practices in pregnancy

Food safety is a key concern during pregnancy because of women's increased susceptibility to foodborne illness (Athearn et al., 2004; Jamieson et al., 2006). Specific foods and food preparation/ handling have been identified to be high-risk for potential pathogens or toxicity to pregnant women. Because of their risk, these foods and handling techniques are incorporated into the NZPBG (Ministry of Health, 2006). In particular foods such as chilled or prepared ready-to-eat, soft and semi-soft pasteurised cheeses, cold deli salads, cold cooked or smoked chicken/seafood/fish, processed meats, raw meat/ vegetables/ fruit/ dairy products/ eggs, soft-serve ice cream, cream, custard, and tahini containing dips are recommended to be avoided (Ministry of Health, 2006). Food preparation, handling, storage, hygiene, and sanitation are also of paramount importance (Athearn et al., 2004; Kendall, Medeiros, Hillers, Chen, & Dimascola, 2003; Ministry of Health, 2006; Redmond & Griffith, 2003). Because of the importance of food safety, it is important that recommendations are communicated to women. If recommendations are not being met it could suggest that alternative communication strategies are required to ensure women make optimal dietary choices.

2.9.1. Women's food safety knowledge and adherence

In GUiNZ 87% of women deliberately avoided various food or drinks, including those recommended in the NZPBG (Morton et al., 2014). Although most women were aware of food safety recommendations their behaviours did not always reflect this knowledge. The most common foods avoided included raw seafood (45%), processed/ pre-cooked meats (35%), and soft pasteurised cheese (31%). These results agreed with a survey conducted in South Auckland women (n=100) which found women's food safety knowledge and adherence was poor (Rungan & Badkar, 2005). It was however reported that only 58% of women had received food safety advice. Results may have been affected by small sample size and cultural distribution.

Worldwide dietary changes are frequently reported during pregnancy because of food safety concerns. Common changes include greater concerns when handling food, increased cleanliness, reduced eating out, and consumption of fewer raw food products (Athearn et al., 2004; Ogunmodede et al., 2005). Verbeke and De Bourdeaudhuij (2007) found pregnant women were more likely to ensure meat was well cooked (66%), vegetables were washed (80%), and they washed their hands before eating (38%) compared to nonpregnant women (25%, 65%, 22% respectively). Women also more frequently reported avoiding alcohol and tobacco. However, not all evidence aligns with recommendations as shown in GUiNZ. Focus group findings of 69 American women who were pregnant or within six months postpartum indicated women consumed unheated deli/lunch meats (65%), soft cheeses (40%), and raw egg within home baking (40%) during pregnancy (Athearn et al., 2004). Other barriers to making food safety changes that have been identified include a lack of knowledge about food cleaning/cooking/chilling recommendations, cultural/ traditional practices, habits, and affordability (Trepka, Murunga, Cherry, Huffman, & Dixon, 2006). Others have suggested adherence to recommendations is higher when recommendations for specific foods is given by health professionals than family and friends (Athearn et al. (2004).

Although food safety during pregnancy is a concern there is a lack of communication and understanding of recommendations in NZ. Additionally, there is a lack of evidence surrounding food safety practices during lactation.

2.10. Dietary information sources used during pregnancy and lactation

Previous studies have identified a variety of information sources used during pregnancy and lactation.

Information sources used during pregnancy

GUiNZ identified women most commonly received information from midwives (78%), GP's (34%), books/magazines/newspaper (29%), friends (22%), family (23%), and the internet (18%) (Morton et al., 2010). When asked who women believed was the most trustworthy dietary information source midwives (84%), GP's (69%), family (38%), nutritionists (33%),

printed media (28%), friends (24%), obstetricians (27%), and antenatal classes (21%) were reported (Morton et al., 2010).

Worldwide similar sources have been reported. In Australia (n=350) the main source of dietary information were midwives (70%) (Grimes, Forster, & Newton, 2014). Of those who had midwives as their LMC, 28% believed they were the best information source during pregnancy. Other sources women used included family (52%), friends (52%), the internet (44%), written resources (39%), books (17%), and group sessions (2.4%). A high use of the internet, midwives, and books were also reported by well-educated older Dutch women (n=100) during preconception and pregnancy (Szwajcer et al., 2007). In Australia (n=190) information sources about omega-3-fatty-acids included books/ magazines (28%), GP (26%), and midwives (20%) (Sinikovic, Yeatman, Cameron, & Meyer, 2009). Because this study only investigated omega-3 fatty acids it is unknown if information sources for general nutrition would differ. Similar limitations occurred in an American study (n=689) that identified health professionals, magazines/ books, friends/ family, health classes, and television as the most frequently reported sources of listeriosis information (Ogunmodede et al., 2005).

Other information sources have also been reported. In Swedish focus groups, women (n=23) reported receiving limited information from midwives (Wennberg, Lundqvist, Högberg, Sandström, & Hamberg, 2013). They, however, reported receiving information from their own research, health professionals, friends, family, and the internet. These findings shared similar characteristics with a 2004 American study that reported 39% of women received information from their family. Other sources included intuitive (51%), printed media (48%) health professionals (27%), and audio/visual (7%) (Athearn et al., 2004). Other reported information sources that have not been mentioned include alternative health practitioners, the media, pharmacists, and IVF clinics (Frawley et al., 2014; Hämeen-Anttila et al., 2014; House & Coveney, 2013; Sinikovic et al., 2009; Tuffery & Scriven, 2005).

Information sources used during lactation

There is less evidence surrounding women's information sources during lactation than pregnancy. Unlike pregnancy the postpartum period is a time of advice for multiple factors such as breastfeeding, infant feeding practices, and lifestyle modifications, therefore it is

difficult to decipher what extent women are receiving advice specifically for their diet during lactation (Morton et al., 2012).

In GUiNZ postpartum women received dietary advice from a range of sources including Plunket (93%), family or friends (77%), books (44%), internet (40%), magazines (34%), GP (24%), midwives (14%), and self-knowledge (6%) (Morton et al., 2012). This aligns with previous studies showing predominant information sources are the media/ internet, nurses, midwives, friends, family, and GP's (Alianmoghaddam, Phibbs, & Benn, 2018; Baranowski et al., 1983; Jeong et al., 2017; Kulakac et al., 2007; Pepino & Mennella, 2004).

Other studies have also shown sources for specific information. In women whose infants were experiencing colic (n=21), many expressed confusion about dietary information received (Kidd et al., 2019). Women received information from health professionals, books, the internet, friends, and family members however many reported conflicting advice. In women who took alternative supplements pharmacists (51%), doctors (48%), family or friends (46%), internet (44%), and lactation consultants (30%) were the most common information sources (Sim et al., 2013). Other sources included naturopaths, nurses, food stores, and books/ literature. These studies show slightly different sources of information which may suggest the type of information women require affects the sources they use. Currently in NZ women have the option to receive postnatal care from a variety of professionals including midwives, Plunket nurses, and lactation consultants. Further nutrition education of these professionals may provide further opportunities to promote optimal dietary choices.

2.10.1. Educational resources available in New Zealand for pregnancy and lactation

Handouts are an important way that guidelines are communicated to women in NZ. In NZ the Ministry of Health and other government bodies such as the Health Promotion Agency have developed resources on key topics related to nutrition in pregnancy and lactation. The current NZPBG has accompanying health education resources for "Eating for Healthy Pregnant Women" and "Eating for healthy breastfeeding women". In addition to these, there are 57 nationally recognised handouts available to NZ women that provide information about

nutrition and wellbeing during pregnancy (Ministry of Health, n.d.). There are an additional 20 resources to support feeding practices after birth (Ministry of Health, n.d.). Available handouts, such as “Food safety in pregnancy” and “Avoiding listeria” provide dietary information targeted towards different population groups in NZ. Despite the large amount available, the use and effectiveness of handouts is currently unclear.

2.11. Concluding statement

Food and nutrition guidelines during pregnancy and lactation are complex and there is currently a gap in the knowledge about women’s behaviours as they transition from pregnancy into lactation. The provision of evidence-based information needs to be regularly reviewed to ensure that it is contemporary and meeting the needs of pregnant and lactating women.

Chapter 3: New Zealand women's dietary choices during pregnancy and lactation

3.1. Abstract

Aim: To explore New Zealand women's dietary choices, food safety practices, and sources of nutrition information during pregnancy and lactation.

Methods: Women were recruited during pregnancy or within 6 months postpartum and completed questionnaires on dietary choices, food safety, and sources of nutrition information.

Results: Women (n=458) from around NZ participated in the study. They consumed a wide range of foods and beverages and reported various dietary changes. In pregnancy women most commonly reported avoiding alcohol (92%), raw milk and milk products (86%), and raw/smoked/precooked seafood or fish (84%). Food avoidance was less common in lactation. However, fewer women consumed milk products during lactation (64%) than pregnancy (93%). Women also increased or added (69% pregnancy, 52% lactation) and limited (81% pregnancy, 66% lactation) foods. High-risk foods and drinks were mostly avoided during pregnancy such as alcohol and raw foods because of advice from the NZ pregnancy guidelines (88%) or because of food safety concerns (68%). Dietary information was acquired from a range of sources. During pregnancy, more reliable sources were used including midwives (37%) and NZPBG (25%). Potentially unreliable sources were used more frequently in lactation including alternative health practitioners (26%) and family/friends (12%).

Conclusion: Women are likely to alter their diet during pregnancy following advice from the NZ pregnancy guidelines, health professionals, or because of food safety concerns. Lactating women often make dietary changes because of infant symptoms or advice received from potentially less reliable sources.

3.2. Introduction

Health and nutrition concerns of women, particularly those for the growing fetus/ infant, often become more prominent during pregnancy and lactation (Olson, 2005). Women frequently report changing their diet to achieve the best possible outcomes (Hillier & Olander, 2017; Kidd et al., 2019; Pullon et al., 2018). Evidence-based guidelines in NZ *"Food and Nutrition Guidelines for Healthy pregnant and breastfeeding women"* (NZPBG) developed by the Ministry of health in 2006 promote food and lifestyle based recommendations (Ministry of Health, 2006). Compared to non-pregnant and non-lactating women food-based recommendations change to meet altered nutrient requirements during pregnancy and lactation. Women are recommended to consume additional servings of vegetables, dairy products, protein, and grain foods (Ministry of Health, 2006).

There is a wealth of food safety advice for pregnant women because of the increased risk of foodborne illness (Bondarianzadeh, 2007; Jamieson et al., 2006; Pezdirc et al., 2012; Smith, 1999). Food safety recommendations are therefore particularly complex and comprehensive. Women have an increased susceptibility to listeriosis, toxoplasmosis, salmonella, botulism, influenza, varicella, and methyl mercury toxicity during pregnancy (Bondarianzadeh, 2007; Jamieson et al., 2006; Pezdirc et al., 2012; Smith, 1999). Alongside increased susceptibility, women also have an increased risk of infection severity, miscarriage, premature birth, still-birth, and fetal and maternal mortality (Bondarianzadeh, 2007; Donnelly, 2001; Jamieson et al., 2006; Madjunkov et al., 2017). High-risk foods that have been identified include soft cheeses, cold deli salads, cold cooked or smoked meats, processed meats, raw products, soft-serve ice cream, tahini, and ready-to-eat meals (Madjunkov et al., 2017; Ministry of Health, 2006; Verbeke & De Bourdeaudhuij, 2007).

Evidence from NZ and elsewhere suggests that women are likely to avoid a variety of foods during their pregnancy based on the advice they receive from health professionals (Forbes et al., 2018; Morton et al., 2010; Pullon et al., 2018). Whether women who are breastfeeding continue to avoid a variety of foods is less well understood. Dietary advice during pregnancy and lactation is important to support the recommended dietary changes (Ministry of Health, 2006). Previous studies have identified midwives, general practitioners (GP), printed media,

friends, and family as common nutrition information sources (Growing Up in New Zealand, 2014). This study aimed to determine women's dietary choices, food safety practices, and sources of nutrition information during pregnancy and lactation. This evidence is important to understand what support future women require to make optimal dietary choices during pregnancy and lactation.

3.3. Methods

This cross-sectional, observational study recruited pregnant and lactating women throughout NZ. To meet the inclusion criteria women were required to be pregnant or within six months postpartum (Appendix C). Recruitment was conducted between January and June 2019 via social media, professional associations, posters, word of mouth, and personal contact (Appendix K). Participants were self-selected and therefore not representative of the NZ population. The questionnaires were developed by the research team of registered nutritionists and dietitians to align with the current NZPBG (appendix F-J) (Ministry of Health, 2006). Questionnaires from the growing up in NZ study (GUiNZ) provided some guidance for question flow and wording (Growing up in New Zealand, 2009a, 2009b). Validated food frequency questionnaires (FFQ) and dietary recommendations from the Ministry of Primary industries and the NZPBG guided foods that were included in the questionnaires. Pilot testing was conducted with 14 pregnant women and women who had recently given birth. Pilot testing resulted in minor wording changes to increase readability.

Demographic information included health status, parity, food security, age, ethnicity, qualifications, and geographical location (Appendix F). Demographic information was collected at the beginning of the questionnaire. Food choice questionnaires (FCQ) (Appendix H and J) explored avoidance, addition, and limitation of foods, supplement use, and information sources. The FFQ's (Appendix G and I) explored women's daily, weekly, monthly, and occasional consumption of fruit, vegetables, protein foods, dairy, grains, and beverages. These questionnaires explored women's food choices and food variety and were not designed as a complete dietary assessment. Portion sizes and number of servings were not included.

The questionnaires took approximately 10-15 minutes to complete. Questionnaires favoured closed questions to maximise responses. Open questions were used to allow women to express additional information. This qualitative data has been used to provide further justification where appropriate. The option of "choose not to answer" was provided to skip questions. Ethical approval to conduct this study was gained from the Massey University Human Ethics Committee (MUHEC): Southern A (application 28/09). Statistical analysis was conducted using IBM SPSS statistics (version 24.0). Descriptive statistics, including mean, standard deviation, frequency, and percentage were calculated through multiple response sets and custom tables. Chi-squared tests were used to compare women's education level and alcohol intake. The homogeneity of the sample demographics did not allow an analysis of factors influencing dietary intake.

3.4. Results

All participants who completed allocated questionnaires were included in the analysis (n=458). The pregnancy FFQ was completed by all women and 442 completed the FCQ. Of women who completed the pregnancy questionnaires, 182 took part during their pregnancy and the remaining 276 completed them retrospectively. Eligible women (n=290) then completed the lactation FFQ (n=290) and FCQ (n=284). Respondents were largely well-educated European women with adequate food availability (96%) from all around NZ (Table 3.1, Figure 3.1). Women mostly reported good health before pregnancy (94%). Thirty-one-percent of women reported a change in their health during pregnancy, the majority (83%) felt that their health status declined. Iron deficiency and heartburn were the most common diagnoses (Table 3.1).

Table 3.1. Participant characteristics

		Total n (%)
Participants		458 (100%)
Mean age (years ± SD)		32.5 ± 6
Ethnicity (Multiple responses allowed)	NZ European	433 (95%)
	Māori	42 (9%)
	Pacific Island	18 (4%)
	Asian	23 (5%)
	Other *	33 (7%)
Qualification	Secondary	77 (17%)
	Tertiary	380 (83%)
First baby	No	261 (57%)
Number of children	One	192 (74%)
	Two or more	68 (26%)
	Choose not to answer	1 (0%)
Diagnosis during pregnancy (multiple responses allowed)	Iron deficiency	219 (48%)
	Anaemia	29 (6%)
	Heartburn	160 (35%)
	Gestational diabetes	23 (5%)
	High blood pressure	17 (4%)
	Other #	45 (10%)

*Other ethnicities: African, South African, British, Kurdish, Latin American, Russian, Scottish

Other diagnoses: Hyperemesis gravidarum, pre-eclampsia, cholestasis, fibroids, hypothyroidism, morning sickness, prolapsed disc, low platelets, tachycardia, constipation, polyhydramnios, B12 deficiency, thrush

Figure 3.1. Geographical spread of cohort

3.4.1. Dietary choices

Women consumed a range of foods during pregnancy and lactation (Table 3.2). Women added or increased foods in pregnancy (69%) and lactation (53%) (Table 3.3). Most commonly dairy products, nuts, and green leafy vegetables were added. Women's reasons for adding or increasing foods were to increase dietary iron and/or calcium (52%), food cravings (49%), and to support baby's health (46%). During lactation, the most common reasons were to support their baby's health (42%), increase dietary calcium and/or iron (36%), and food cravings (29%). In pregnancy (88%) and lactation (70%), women reported avoiding foods, including alcohol, raw milk and milk products, raw, smoked or pre-cooked fish or seafood (Table 3.4). The main reason for avoidance during both pregnancy (88%) and lactation (48%) was following the NZPBG. Other reasons in pregnancy were because of advice from health professionals (68%), advice from internet/magazine/book/newspaper (36%), and advice from family or friends (27%). During lactation avoidance reasons included advice from health professionals (28%), food preferences (26%), and food safety concerns (12%). Food limitation was more common during pregnancy (81%) than lactation (66%) (Table 3.5). Women limited food in pregnancy because of mercury concerns (35%), food preferences (35%), and cadmium concerns (6%). In lactation dislike of foods (25%), and mercury concerns (7%) were the most common reasons.

Women's dietary choices were affected by a variety of factors. In pregnancy women frequently commented that nausea, previous pregnancy complications, or IVF pregnancies

influenced food choices. Women's diets were more relaxed when suffering from nausea and were stricter if conception was difficult.

"This pregnancy is a result of IVF after years of infertility. Anxiety-related to this may have caused me to be even more cautious than I might have been otherwise".

Common influences during lactation included tiredness, inability to prepare food due to limited time, and baby's symptoms.

"Time to eat well is very difficult. Getting a variety of foods each day is so hard with a new-born!"

"The biggest change in my diet is that I am eating way more store-bought products rather than making them myself (e.g. muesli bars, bliss balls, muesli, sauces, nut butter etc). This is mainly to save time and energy".

Table 3.2. Foods and beverages consumed daily during pregnancy and lactation

Daily food group consumption	Pregnancy n (%)	Lactation n (%)
Dairy		
Milk	428 (93%)	187 (64%)
Milk alternatives	73 (16%)	73 (25%)
Yoghurt	213 (47%)	100 (34%)
Cheese	116 (25%)	96 (33%)
Ice cream	34 (7%)	24 (8%)
Protein		
Red meat	189 (41%)	151 (52%)
Poultry	230 (50%)	148 (51%)
Fish	23 (5%)	14 (5%)
Legumes	52 (11%)	41 (14%)
Nut or nut butters	211 (46%)	149 (51%)
Seeds	126 (28%)	92 (32%)
Tofu	8 (2%)	6 (2%)
Grains		
Bread	376 (82%)	245 (84%)
Breakfast cereals	273 (60%)	159 (55%)
Fruit and vegetables		
Fruit	404 (88%)	241 (83%)
Vegetables	410 (89%)	258 (89%)
Beverages		
Water	451 (98%)	283 (98%)
Tea	222 (48%)	136 (47%)
Coffee	193 (42%)	146 (50%)

Table 3.3. Foods and drinks added or increased in the diet during pregnancy and lactation

Foods added or increased	Pregnancy n (%)	Lactation n (%)
Dairy products	211 (48%)	66 (23%)
Nuts	136 (31%)	75 (26%)
Green leafy vegetables	130 (29%)	68 (24%)
Meat	84 (19%)	39 (14%)
Salmon	56 (13%)	31 (11%)
Fortified cereals	58 (13%)	36 (13%)
No additions	139 (31%)	134 (47%)
Other *	42 (10%)	23 (8%)

* Pregnancy: spirulina, peanut butter, eggs, confectionary, celery, seeds, tomato, bread, fruit, jalapenos, iron rich foods, bran, Quorn, orange juice, white fish, porridge, seaweed, avocado, vegetables, fruit, herbal tea, olives, dates, tofu, sardines, water
Lactation: oats, flaxseeds, alcohol, sushi, meal replacement drinks, brewer's yeast, tofu, sardines, water

Table 3.4. Foods and beverages avoided in the diet during pregnancy and lactation

Foods and drinks avoided	Pregnancy n (%)	Lactation n (%)
Alcohol	408 (92%)	176 (62%)
Raw (unpasteurised) milk and milk products	379 (86%)	99 (35%)
Raw, smoked, or precooked fish or seafood	371 (84%)	57 (20%)
Cold precooked meats	335 (76%)	39 (14%)
Processed meats	315 (71%)	42 (15%)
Ready-made salads	313 (71%)	28 (10%)
Tahini	300 (68%)	29 (10%)
Foods containing raw egg	296 (67%)	24 (8%)
Soft-serve ice cream	288 (65%)	37 (13%)
Hummus	255 (58%)	16 (6%)
Soft pasteurised cheese	232 (52%)	35 (12%)
Cream or custard	212 (48%)	29 (10%)
No foods or drinks avoided	52 (12%)	84 (30%)
Other*	13 (3%)	12 (4%)

* Pregnancy: mayonnaise, sprouts, coffee, caffeine, eggs.

Lactation: caffeinated coffee, onion, spicy food, dairy products, chocolate

Table 3.5. Foods limited in the diet during pregnancy and lactation

Foods limited in diet	Pregnancy n (%)	Lactation n (%)
Canned fish	160 (36%)	36 (13%)
Bluff or Pacific oysters or Queen scallops	136 (31%)	43 (15%)
Longer lived and larger fish	130 (29%)	30 (11%)
Deep sea or lake fish	128 (29%)	33 (12%)
Brown seaweed	128 (29%)	37 (13%)
Red or green seaweed	118 (27%)	39 (14%)
No limitations	85 (19%)	97 (34%)
Choose not to answer	17 (4%)	8 (3%)

Milk and milk products

Daily consumption of cow's milk was more commonly reported in pregnancy than lactation (Table 3.2). Lactating women reported avoiding milk products because of a belief that dairy caused infant colic, reflux, or allergic symptoms, or following advice from health professionals, family or friends, or information sourced from the internet.

"Have now cut out dairy from diet for baby not confirmed issue but precaution due to reflux and colic"

"Trying to be dairy-free for my bubs".

Women who chose milk alternatives also more frequently reported choosing non-fortified milk alternatives (52% in pregnancy and 56% lactation).

Protein foods

Women consumed a range of protein sources (Table 3.2). Some women who followed meat-free diets commented that they had added sources of animal protein to their diet during pregnancy.

"Prior to being pregnant I was vegan, I am no longer vegan and will go back to being vegan once I am done breastfeeding"

"Pre-pregnancy I mainly ate a vegetarian (pescatarian) diet as my husband is a vegetarian. I have been trying to increase my consumption of meat since becoming pregnant".

Oily fish (salmon, tuna, mackerel, and sardines) was consumed at least once a week by a third of both groups (Table 3.6). Women frequently commented that they increased their fish intake, however, only 13% increased their intake of salmon (Table 3.3).
"*I spent the first-trimester vegan but then relaxed and became vegetarian. Over the last month (roughly) I began to eat a small amount of fish".*

Table 3.6. Meat and fish consumed at least once a week during pregnancy and lactation

Food group consumption at least once a week	Pregnancy n (%)	Lactation n (%)
Fish	201 (44%)	135 (47%)
Red meat	201 (44%)	106 (37%)
Poultry	165 (36%)	108 (37%)

Fruit, vegetables, grains and beverages

Both groups consumed a wide range of fruit, vegetables, grains, and beverages (Table 3.2). Women often reported their fruit and vegetable choices were influenced by seasonality. Women most frequently consumed three types of fruit and three types of vegetables daily in pregnancy. In lactation, women reported consuming two types of fruit and five types of vegetables daily. Both pregnant (82%) and lactating (84%) women consumed bread daily. Wholegrain versions were chosen by 29% pregnant and 39% of lactating women. Caffeine-containing beverages were consumed daily by approximately half of women in both groups (Table 3.2). Women were aware of caffeine recommendations and commonly reported avoiding caffeine entirely or choosing decaf versions rather than limiting intake.
"*I have drunk decaf tea and coffee all pregnancy".*

Supplements

During pregnancy 96% of women took folic acid supplements, 95% took iodine supplements, and 70% took other supplements including iron, calcium, magnesium, fish oil, selenium, zinc, vitamin C, vitamin B complex, probiotics, and vitamin D. During lactation 26% continued taking folic acid supplements and 63% continued iodine supplements. Other supplements (60%) included garlic oil, fenugreek, Chinese herbs, evening primrose oil, spirulina, blessed

thistle, brewer's yeast, selenium, collagen, and glucosamine. Various reasons for supplement use were reported (Table 3.7).

Table 3.7. Reasoning for taking supplements in pregnancy and lactation

Reasoning for taking supplements	Folic acid pregnancy n (%)	Folic acid lactation n (%)	Iodine pregnancy n (%)	Iodine lactation n (%)	Other pregnancy n (%)	Other lactation n (%)
Health professional's advice	396 (93%)	39 (52%)	388 (92%)	144 (81%)	201 (65%)	84 (49%)
Following NZPBG	254 (60%)	14 (19%)	221 (53%)	36 (20%)	103 (33%)	20 (12%)
Advice from family member or friend	53 (12%)	6 (8%)	44 (10%)	4 (2%)	50 (16%)	20 (12%)
Advice from internet, magazine, book, or newspaper	37 (9%)	4 (5%)	27 (6%)	4 (2%)	27 (9%)	17 (10%)
Blood tests confirmed a deficiency	NA	NA	11 (3%)	2 (1%)	28 (9%)	5 (3%)
Other*	15 (4%)	27 (36%)	10 (2%)	26 (15%)	76 (25%)	74 (43%)

*Pregnancy: lacking in diet (vegan, vegetarian), reduce morning sickness, instead of Elevit, increases fertility, common knowledge, took in previous pregnancy, always taken, tiredness, boost nutrition, overall health and energy

Lactation: lacking in diet (vegan, vegetarian) finishing off supplements, supporting milk supply, ensure dietary adequacy, post-partum haemorrhage, always taken, sleep, tiredness, boost nutrition, overall health and energy

3.4.2. Food safety practices

Women reported being aware of food safety recommendations and 68% purposely avoided food and beverages during pregnancy because of food safety concerns (Table 3.4). Additionally, 88% reported using NZPBG, which incorporates food safety recommendations. Some women (11%) did not avoid any foods or beverages. Women commented being more relaxed about food safety and dietary choices during consecutive pregnancies because of limited time with multiple children, fatigue, or finding recommendations hard to adhere to.

"I tried to eat as healthy as possible, the national food guidelines were helpful, I was surprised by the amount of food restrictions due to listeria risk"

"Never ate anything considered to be a 'risk' food for pregnant women"

3.4.3. Information sources

Women's most influential information source varied between the groups (Table 3.8).

Table 3.8. Greatest influence on dietary choices

Greatest influence on dietary choices	Pregnancy n (%)	Lactation n (%)
Midwife	164 (37%)	86 (30%)
NZPBG	109 (25%)	30 (11%)
Family and friends	34 (8%)	35 (12%)
Internet	20 (5%)	23 (8%)
Obstetrician	22 (5%)	2 (1%)
GP	16 (4%)	8 (3%)
Books, magazines, and/or newspaper	6 (1%)	3 (1%)
Not sure	22 (5%)	13 (5%)
Alternative health practitioner	11 (2%)	74 (26%)
Other *	38 (9%)	10 (4%)

* Pregnancy: Antenatal classes, fast food advertisements, own professional background (GP or dietitian), own knowledge, no-one, appetite, common sense, dietitian/ nutritionist, nausea, pamphlets, choose not to answer

Lactation: Antenatal classes, lactation consultant, fast food advertisements, own professional background (GP or dietitian), own knowledge, no advice received, appetite, common sense, dietitian/ nutritionist, mixed sources, choose not to answer

Information about food and beverage avoidance was more commonly reported than what foods and drinks to consume in pregnancy (Table 3.9). In lactation, there were no clear trends.

Table 3.9. Advice received from information sources in pregnancy and lactation

Advice received	Pregnancy			Lactation		
	LMC advice n (%) n=361	NZPBG n (%) n=109	Antenatal class n (%) n=69	Midwife n (%) n=86	Alternative health practitioner n (%) n=74	Internet n (%) n=23
Foods to consume	243 (67%)	75 (69%)	47 (68%)	58 (67%)	53 (71%)	15 (65%)
Drinks to consume	172 (48%)	61 (56%)	34 (49%)	43 (50%)	32 (43%)	8 (35%)
Foods to avoid/limit	321 (89%)	108 (99%)	59 (86%)	51 (59%)	37 (50%)	14 (61%)
Drinks to avoid/limit	270 (75%)	100 (92%)	61 (88%)	52 (60%)	26 (21%)	13 (57%)
How much food to consume	76 (21%)	23 (21%)	12 (17%)	21 (24%)	21 (29%)	5 (22%)
Supplements to take	258 (71%)	55 (50%)	17 (25%)	45 (52%)	53 (71%)	8 (35%)
Weight changes	160 (44%)	32 (29%)	19 (28%)	16 (19%)	0	9 (39%)
Importance of the diet during pregnancy or breastfeeding	158 (44%)	47 (43%)	34 (49%)	41 (48%)	26 (36%)	12 (52%)
Other*	11 (3%)	0	2 (3%)	2 (2%)	0	0

*Pregnancy: how to avoid GDM, pamphlets, discouraged dieting, eat less fruit (too high in sugar), second pregnancy so did not discuss food in detail, morning sickness weight loss, drinks to lower blood pressure.
Lactation: baby symptoms, how to improve own diet to help baby, how to increase milk production

The majority of women chose midwives to be their LMC (92%), with 6% choosing an obstetrician, and 2% having shared care due to twin pregnancies. Dietary advice from LMCs was received by 87% of women. Information received tended to focus on what not to do (Table 3.9). Antenatal classes were attended by 39% of women during pregnancy and 40% received dietary advice. Multiparous women reported attending antenatal classes in previous pregnancies which was why they did not attend classes. Other reasons for not attending classes were limited availability and timing. Many were scheduled to start classes in the approaching weeks. Women used a range of information sheets during pregnancy (Table 3.10). Food safety and general healthy eating handouts were more commonly used than alcohol-related handouts.

Table 3.10. Handouts used during pregnancy

Handouts used	Total n (%)
Food safety in pregnancy	238 (54%)
Eating for healthy pregnant women	178 (40%)
Food safety: avoiding listeria	155 (35%)
Alcohol and pregnancy: what you might not know	56 (13%)
Drinking and your baby	31 (7%)
Healthy mums: your guide to eating well during pregnancy	20 (5%)
No handouts used	116 (26%)

Lactating women reported the use of many potentially unreliable information sources (Table 3.11).

Table 3.11. Dietary information sources used during lactation

Lactation information sources	Total n (%)
Lead maternal carer	218 (77%)
Internet	190 (67%)
Family and/or friends	190 (67%)
NZPBG	129 (45%)
Plunket	125 (44%)
Other parents	124 (44%)
Health professional/s	93 (33%)
Books, magazines, and/or newspaper	87 (31%)
Television	8 (3%)
Radio	3 (1%)
Other*	13 (5%)
* osteopath, nutritionist, Facebook, dietitian, lactation consultant, our Health Visitor, Pacifica nurses, handouts, apps, birth care	

3.5. Discussion

In an effort to explore New Zealand women's dietary choices during pregnancy and lactation this study used questionnaires to investigate dietary choices, food safety practices, and sources of nutrition information. Women, in this geographically diverse, predominantly NZ European cohort, chose a variety of foods and beverages during pregnancy and lactation. The majority of participants were well educated, of good health and food secure, therefore this cohort is not representative of the NZ population. It does, however, represent women who are educated and food secure with potentially fewer barriers to making optimal dietary choices (Freisling et al., 2006; Morton et al., 2010).

3.5.1. Foods added or increased, limited, and removed (dietary changes)

Food addition/increase, limitation, and removal trends in pregnancy were similar to what was observed in GUiNZ. GUiNZ reported that 41% added and 87% avoided foods during pregnancy (Morton et al., 2014). This was not dissimilar to the 48% added and 92% who avoided one or more foods or beverages in this study. Food limitation was not discussed in GUiNZ pregnant cohort, therefore this study provides new information that approximately 80% of women also limit their consumption of certain foods in pregnancy. This study also provides valuable information on foods being consumed during lactation. Nearly 50% of women did not add or increase foods, 70% avoided foods and/or beverages, and 66% limited foods. During lactation there are no recommendations for food and beverage avoidance, women are however recommended to limit their alcohol and caffeine intakes (Ministry of Health, 2006). Considering the large proportion of lactating women who avoid and/or limit foods and beverages there is evidence to suggest women do not adhere to the current NZPBG recommendations. The reasoning for this is unclear, however communication of dietary recommendations and confusing messages could be possible reasons. Further research is required to distinguish why women avoid and limit foods in lactation.

3.5.2. Reasoning for dietary change

Women reported a variety of reasons for dietary changes including following the NZPBG, to increase dietary iron/ calcium, food cravings, food safety, to support babies' health, and because of advice from health professionals. Dietary choices were also impacted by other factors such as morning sickness and conception difficulty in pregnancy and fatigue and infant symptoms in lactation. A large proportion of women reported using the NZPBG when making dietary changes, justifying its importance. There are however limitations to the current NZPBG as they do not provide comprehensive recommendations for managing and making dietary changes, how to cope with fatigue when preparing meals, and how the maternal diet affects infant symptoms. Additionally, there is a lack of emphasis on what women can eat during pregnancy and lactation, which could account for more women removing and limiting foods than adding.

3.5.3. Milk and milk product consumption

Milk consumption was less commonly reported in lactation as women often feared they were causing infant discomfort. Women's consumption of calcium-fortified milk alternatives was also low, with over 50% of chosen milk alternatives being unfortified. Removing calcium sources, such as milk, without replacing with fortified alternatives increases a woman's risk of not meeting calcium recommendations during lactation (Ministry of Health, 2006). In NZ milk is the highest dietary calcium source (27%) for all age groups and genders (Parnell et al., 2011).

There is evidence to suggest that maternal restriction of antigen foods, such as cow's milk and eggs, is beneficial for some infants suffering from atopic eczema (Kramer & Kakuma, 2014). The evidence supporting the protection from other allergies is weak, which supports the NZPBG recommendations that women should not purposely avoid foods (Kramer & Kakuma, 2014). Food avoidances could result in dietary deficiencies and increase the infant's risk of developing allergies (Jeong et al., 2017; Kramer & Kakuma, 2014; Ministry of Health, 2006). Physiological changes, especially bone turnover, are protective of the infant's average procurement of 260mg/day of calcium at the mother's expense (C. S. Kovacs & Kronenberg, 1997; Prentice, 2000a). Women's bone mineral density (BMD) has been shown to decrease by 1-3% per month during lactation, exceeding postmenopausal loss of 1-3% per year (C. S. Kovacs & Kronenberg, 1997). Bone density is then regained once breastfeeding is ended and menstruation returns (Prentice, 2000a). The current consensus suggests that bone loss is independent of maternal calcium intake and low calcium diets during lactation do not increase woman's risk of osteoporosis in later life (C. Kovacs & Ralston, 2015). BMD is however affected by breast milk output, which explains why women with multiple offspring have an increased bone mineral loss (Laskey et al., 1998). Exceptions have also been observed for adolescents who also require calcium for skeletal growth, or those with higher calcium requirements including multiple fetuses or those undergoing heparin treatment (Bezerra, Laboissière, King, & Donangelo, 2002; Oliveri et al., 2004). There is a lack of evidence about the long-term consequences of low calcium diets in lactation and the implications if low calcium diets are continued after lactation (Chowdhury et al., 2015; Laskey & Prentice, 1999; Laskey et al., 1998; Marangoni et al., 2016; Prentice, 2000b; Sowers et al.,

1993). Because a significant proportion of women are avoiding calcium foods during lactation it is possible that the current calcium recommendations are not being met. Additionally, there is a significant amount of confusion surrounding the maternal diet and infant symptoms suggesting the need for further recommendations surrounding the benefits and consequences of food avoidance in lactation.

3.5.4. Protein, bread, fruit, vegetables, and caffeine consumption

Protein intakes were as expected with the main sources being poultry, red meat, and nuts/ nut butters. The trend of non-meat eaters choosing to add meat into the diet during pregnancy and lactation was interesting, particularly because the current guidelines suggest that a well-balanced vegetarian or vegan diet can meet nutritional and energy requirements (Ministry of Health, 2006). More than 80% of women consumed bread daily during both pregnancy and lactation. It is expected that women, therefore, will be benefiting from NZ's iodine fortification of bread and would likely benefit from similar folate fortification schemes. Fruit and vegetable intake seems to vary depending on seasonality. The trends of seasonality emphasise further refining of the NZPBG are needed to ensure different micronutrient and food safety recommendations are met throughout the four seasons. Caffeine intake did not substantially differ between pregnancy and lactation with approximately half of women consuming caffeine beverages. There tended to be confusion about caffeine recommendations as women were very cautious of their consumption, often choosing decaf versions instead of the recommended limitation (Ministry of Health, 2006).

3.5.5. Supplements

Folic acid and iodine are recommended to be supplemented in pregnancy (Brough et al., 2015; Ministry of Health, 2006). In lactation, iodine is the only recommended supplement (Ministry of Health, 2010). Supplement intake was higher than previously observed in NZ, with over 95% of women taking folic acid and iodine during pregnancy in this cohort. In 2018, 84% of 535 NZ women adhered to both folic acid and iodine intake during pregnancy (Reynolds & Skeaff, 2018). In the same study, fewer women took iodine in lactation (63%). Iodine supplementation in pregnancy and lactation was higher than identified in a 2011 study (70% and 36% respectively), that took place soon after supplements were recommended,

suggesting that more women are aware of iodine recommendations (Brough et al., 2015). There is a lack of recommendations for iodine supplementation in the current NZPBG because guidelines have changed since the last update (Ministry of Health, 2010). Inclusion of recommendations in a revised NZPBG may increase women's supplement use because a large number currently use the NZPBG when choosing supplements. A significant number of women took alternative supplements in both pregnancy (70%) and lactation (60%) because of advice from health professionals or following the NZPBG. There are currently no guidelines supporting the use of these supplements, suggesting that women require further evidence-based recommendations about alternative supplements. Of the alternative supplements reported there is limited evidence to support beneficial effects to health. The use of alternative supplements, therefore, is unnecessary. Our results were similar to previous studies, suggesting alternative supplement use is commonly reported by women (Hall, Griffiths, & McKenna, 2011).

3.5.6. Food safety practices

Similar to GUiNZ a large percentage of women were aware of food safety recommendations (Morton et al., 2014). There were however differences in foods avoided, with more women avoiding high-risk foods and drinks in this study. These results also showed higher adherence to food safety recommendations than what was observed in South Auckland women in 2005 (Rungan & Badkar, 2005). Alcohol was the most commonly avoided substance during both pregnancy and lactation, yet a number (8%) of women continued to consume alcohol during pregnancy. The consequences of alcohol consumption are widely understood and NZPBG recommends avoiding alcohol (Ministry of Health, 2006). In this study, there were differences in alcohol consumption between women's education level, with tertiary-educated women being 2x more likely to avoid alcohol. These discrepancies between alcohol consumption suggest that further alcohol-related pregnancy campaigns are required, particularly for those with secondary level education. The use of alcohol-related handouts was lower than other topics. This could explain why some women continue consuming alcohol.

3.5.7. Dietary information sources

Women acquired dietary information from a range of sources that were not dissimilar to sources identified in GUiNZ (Morton et al., 2010). Midwives were the most influential information source during both pregnancy and lactation. It seems during pregnancy nutrition advice is commonly received from qualified health professionals, such as midwives. Although it was good women received dietary advice from midwives, midwives are currently not formally educated in nutrition in NZ (Arrish, Yeatman, & Williamson, 2014). Additionally, previous studies have reported that midwives lack knowledge around nutrition recommendations and do not feel confident giving nutrition advice, particularly for vegetarian women or those with health conditions (Arrish et al., 2014; Yin, Dixon, Paterson, & Campbell, 2014).

As women's dietary choices are often influenced by dietary advice from midwives, further strategies to improve midwives knowledge or the increased availability of nutrition professionals would be warranted. Nearly the opposite was observed during lactation with the majority of women relying on alternative health practitioners, the internet, and friends/ family. The reasoning behind this difference in information procurement is likely because of the current nutrition NZPBG. The guidelines have a large emphasis on dietary recommendations during pregnancy, particularly food safety, but little on lactation (Ministry of Health, 2006). Additionally, there is a change in health professionals available to women. LMC's will continue to care for women until 6 weeks postpartum, after which a Well-child provider will be available. Similar to midwives Well-child care providers are not formally trained to provide nutrition advice and nutrition education is not their key priority (Ministry of Health, 2015b). The lack of evidence-based support during lactation may be the reason for food removal trends. Information received from all sources was commonly about foods and beverages to avoid rather than what should be added or included in the diet. This was translated into more women removing and limiting than adding or increasing foods during pregnancy and lactation.

Women are recommended to increase their servings of food groups, however practical explanations of how recommendations can be met are not given. Instead, there is a large

emphasis on the importance of removing specific high-risk foods such as alcohol and raw meats (Ministry of Health, 2006). From previous studies, women found dietary recommendations easier to adhere to when foods were specifically mentioned (Athearn et al., 2004). Specifically mentioning the nutrients of concern, dietary requirements, and how to meet these requirements could be a way of improving the current recommendations. Nearly 60% of women already had children, which was a major factor for the limited use of antenatal classes. Women tended to attend antenatal classes during their first pregnancy and not in later pregnancies. Currently, there are no regulations for the quantity or quality of nutrition advice given at antenatal classes, however, they may provide dietary advice (Citizens information, 2017). Additionally, as attendance reduced during subsequent pregnancies in this study the importance of other mediums for evidence-based dietary information, particularly if recommendations change, is emphasised.

This study provides valuable information surrounding the dietary choices of 458 geographically diverse pregnant and lactating NZ women. Currently, evidence of women's dietary choices, food safety practices, and nutrition information sources is limited in NZ. This is particularly true for food choices in lactation. This cohort's demographics were a limitation as women were predominantly European, highly educated, food secure, and of good health status. This is study is therefore not representative of the NZ population and disallowed comparisons between different ethnic and socioeconomic groups. Further research would be required to investigate differences between ethnicity and socioeconomic status.

3.6. Conclusion

Women make dietary changes during pregnancy and lactation including adding, limiting, and avoiding foods. Dietary changes in pregnancy were influenced by many reliable information sources such as NZPBG, health professionals, or because of food safety concerns. In lactation women more frequently received dietary advice from possibly less reliable sources such as alternative health practitioners, the internet, and friends and family. Other common reasons for dietary change in lactation were because of concerns about the impact of the maternal diet on infant symptoms. The lack of evidence-based information sources in lactation highlights the need for changes in how information is communicated to women during this

time. Food safety practices were generally followed by women, however, there is room for improvement especially considering this cohort's highly educated demographics.

Chapter 4: Conclusions and Future Recommendations

4.1. Study summary and achievement of aims and objectives

This cross-sectional, observational study was designed to provide insight into NZ women's dietary choices during pregnancy and lactation. Women (n=458) who were pregnant or were less than six months postpartum were included in this study which occurred between January and June 2019. Demographic information was collected on ethnicity, age, socioeconomic status, and parity. Women completed food frequency questionnaires and food choice questionnaires during pregnancy and lactation.

The primary objective of this study was to explore dietary choices during pregnancy and lactation in NZ women. From the data collected, women consume a range of seasonal foods during pregnancy and lactation. Women's food choices were less varied in pregnancy because of food safety recommendations and pregnancy-related symptoms. Some food groups, such as dairy products, were not consumed as expected during lactation. The hypothesis that women's dietary choices alter between pregnancy and lactation was therefore supported by our data.

The second objective was to explore dietary practices surrounding food safety during pregnancy and lactation. Food safety practices of women within the study were as expected with 89% of women avoiding one or more of the recommended foods. The most commonly avoided foods/ drinks were alcohol, raw milk and milk products, and raw/smoked/precooked fish and seafood. The hypothesis that women's dietary choices would reflect concerns of food safety during pregnancy was supported by our data. The food safety practices observed during pregnancy were not seen during lactation.

The final objective was to explore where NZ women acquire dietary information from during pregnancy and lactation. A variety of sources were identified including their LMC, NZPBG, alternative health practitioners, family/friends, internet, antenatal classes, and educational handouts. The hypothesis that women would acquire dietary information from a range of

sources including their LMC, GPs, internet, friends, and family was therefore supported by our data.

4.2. Findings and concluding remarks

Results of this study suggest that NZ women make substantial dietary changes during both pregnancy and lactation. Women were more likely to remove and/ or limit foods than add or increase foods in both pregnancy and lactation. This provides insight that women are aware of recommendations about what they should not consume, but have less awareness of what foods and beverages should be increased in the diet. This suggests the current recommendations are not being effectively communicated to women and highlights the need for improved translation strategies.

The majority of women followed food safety recommendations and it seemed food safety recommendations are well disseminated to pregnant women. For some women recommendations were overwhelming and complicated their normal dietary choices. Others suggested that recommendations were "rules that they strictly adhered to". From these results, food safety recommendations could be further refined to emphasise what foods women need to avoid compared to foods that have limitations. For example foods such as sushi, salads, leftovers, and cold cooked meats can be incorporated into the diet if prepared safely. By emphasising foods that could be included in the diet women may feel more able to meet dietary recommendations while maintaining a diverse diet.

There seems to be an adequate availability of potentially more reliable dietary information during pregnancy. Women reported predominantly receiving advice from health professionals or evidence-based guidelines. As women's dietary choices were commonly influenced by health professionals such as midwives, who currently do not undergo formal nutrition training, further professional upskilling is justified (Arrish et al., 2014). Upskilling will ensure LMC's feel able to and provide correct dietary information. In lactation, women were less likely to receive dietary information from reliable sources. Women frequently received advice from the internet, alternative health professionals, and family or friends. The high use

of potentially unreliable information sources during lactation was concerning and highlighted the importance of developing evidence-based resources and increasing the availability of trained professionals to educate women during lactation. This is particularly important for those who removed foods from their diet, such as milk, following common dietary myths. Similar to pregnancy, upskilling of health professionals that are available during lactation, including LMC's (first six weeks) and Well-child providers (birth to 5 years) could be a strategy to improve nutritional care during lactation.

4.3. Impact

This study appears to have made a valuable contribution to our understanding of the dietary choices that NZ women make during pregnancy and lactation. This evidence, although not representative of the NZ population group, is important for developing an understanding of what women are and are not doing during pregnancy and lactation and why. Because the majority of women included in the study were well educated, European, and food secure the results do not represent the general NZ population. They do however represent women who are more likely to be supported and receive adequate dietary guidance during pregnancy and lactation. Thus, in theory, these women should be more likely to follow the current NZPBG dietary recommendations. Because this was not found, particularly in lactation, this study was able to highlight that changes need to be made in how the guidelines and dietary information is disseminated to women during pregnancy and lactation.

4.4. Strengths

At present, there is a paucity of evidence concerning dietary choices, food safety practices, and information sources of NZ women during pregnancy and lactation. This is particularly true for lactation. A major strength of this study was that it provided insight into what women are doing and why during both pregnancy and lactation. This study contributes valuable information required in NZ to develop an understanding if women are meeting the current recommendations and where they acquire dietary information from.

The cohort size and geographical spread were strengths of the study. Participants were recruited from the bottom of the South Island to the top of the North Island. This was a key difference between this cohort and previous studies and allowed a range of women from different geographical locations to be incorporated into the study results.

The online nature and design of the questionnaires were other key strengths of the study. The questionnaires followed the same simple layout and were relatively easy to complete. It was acknowledged that women would have large time constraints. To reduce participant burden the questionnaires were kept to a maximum of fifteen minutes and skip and display logics were used to reduce the number of questions displayed. The questions that were asked were relevant and gave a good understanding of what women are doing and why. They also provided further evidence that changes need to be made in NZ to ensure women receive appropriate information to make optimal dietary choices during pregnancy and lactation.

4.5. Limitations

One of the largest limitations of the study was time. Six months was allowed for participant recruitment which impacted the number of women who could be reached and who could take part. Not all women were able to take part in both the pregnancy and lactation questionnaires due to their stage of pregnancy at recruitment. Women who were still pregnant at the end of recruitment were unable to complete the lactation questionnaires. This meant that more evidence was obtained for pregnancy than lactation. In future studies, more emphasis on recruitment for women eligible to complete both stages would be warranted. Numbers may also be increased by a longer recruitment period and further recruitment strategies.

The cohort's demographic variables are also a limitation. Women included in the study are predominantly highly educated (graduate degree or higher), European, of multiple parity, food secure, and self-reported good health prior to pregnancy. This means that this cohort is not representative of the general NZ population and cannot be used to make conclusions based on the general population. Further strategies to include a more diverse population

group, including developing cultural recruitment strategies and liaising with cultural advisors, would have improved the translation of study results.

4.6. Recommendations for Future studies

1. Investigate women's dietary intake by the four food groups to develop an understanding if women are meeting the current daily recommendations in both pregnancy and lactation.
2. Further analysis of dietary choices in pregnancy and lactation with a particular emphasis on achieving an ethnically diverse cohort to explore differences between ethnic groups.
3. Investigating if women feel their dietary knowledge is adequate during pregnancy and lactation. This would involve further analysis of what women believe their dietary choices should be, how much dietary information they have received, what information they have received, their perception of the importance of information that they have received, their trust of information sources, and further analysis why women use potentially unreliable information sources, such as the internet.
4. Development of an online medium where women can obtain the current evidence-based information during pregnancy and lactation. Many women in this study were using the internet as an information source, therefore the development of an evidence-based online medium is warranted. A study could be conducted to investigate what women want to know, how they would like this information presented, and how to improve the sources currently used.
5. Develop a greater understanding of infertility and dietary choices. What choices are women making during the preconception period, how supported are they, and how does this impact their diet in pregnancy and lactation.
6. Further analysis of women's dietary choices and BMI changes between pre-pregnancy and postpartum to identify obesity risk.

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Appendices

Appendix A: Supplementary results

1. Demographic questionnaire

1.1. Weight loss and gain before pregnancy

Weight changes before pregnancy	Pregnant n (%) or kg	Infant less than six months postpartum n (%) or kg	Total n (%) or average kg
Attempted to lose weight six months prior to pregnancy	58 (32%)	56 (20%)	114 (25%)
Weight lost	45 (78%)	47 (84%)	92 (81%)
Amount of weight lost	1-30kg	2-16kg	1-30kg
Attempted to gain weight six months prior to pregnancy	2 (1%)	6 (3%)	8 (2%)
Weight gained	0	3 (50%)	3 (38%)
Amount of weight gained		3-5kg	3-5kg

1.2. Baby gender

Baby gender	Pregnant n (%)	Infant less than six months postpartum n (%)	Total n (%)
Male	43 (24%)	137 (50%)	179 (39%)
Female	47 (26%)	139 (50%)	186 (41%)
Unsure	92 (50%)	0	92 (20%)

1.3. Women's additional comments

1) Pregnant with boy girl twins
2) Maybe worth to mention that I am vegetarian.
3) I follow a wholefoods plant based diet
4) I am vegan
5) Pregnant and also breastfeeding my toddler
6) Weight loss due to body building contest, weight lost was gained back.
7) I had low iron and heartburn but were never officially diagnosed with it. I took iron tablets that were prescribed by my midwife.
8) Our baby was an IVF baby after three years, so the loss of weight is part of their criteria as u need to be in your BMI
9) IVF Pregnancy

10) 7th pregnancy (this one, 4 early miscarriages, one living child, one stillbirth at 22 weeks)
11) high glucose in urine without having diabetes
12) We went through ICSI to have our baby
13) Still breastfeeding 2 year old, currently 12 weeks pregnant
14) I have coeliac disease
15) Prior to pregnancy have a low carb lifestyle or keto to maintain weight and to assist general wellbeing
16) I was meant to put that my baby is a boy but accidentally clicked girl
17) anxiety and depression
18) Twin pregnancy, two girls
19) Coeliac disease
20) Live on a dairy farm
21) I am pregnant with boy/girl twins'
22) I have epilepsy and previously suffered from a severe traumatic brain injury
23) Vegetarian diet
24) I am health conscious
25) I have history of an eating disorder in my teens/20s
26) I had a partial molar pregnancy 4 months prior to falling pregnant with my current newborn
27) Studied nutrition and work in healthy lifestyle promotion
28) I am a vegetarian, hence low iron.
29) I was planning on becoming pregnant after the second child was born.
30) I am a birth doula, and I became unexpectedly pregnant after contracting meningococcal disease
31) Prior to being pregnant I was vegan; I am no longer vegan and will go back to being vegan once I am done breast feeding
32) I have Coeliac Disease and IBS. The IBS improved significantly during pregnancy
33) I breastfed my older child through pregnancy also. Am now breastfeeding both.
34) I have hyperemesis gravidarum which greatly affects my food choices
35) Correction of child's both year - 2019 not 1984!
36) I am a picky feeder. but my appetite improves during pregnancy. After pregnancy I go back to the picky feeding again :(
37) Partner is athlete so diet higher in carbohydrates than recommended
38) I have several food allergies - gluten, tomatoes and sensitivity to lactose and sulphites
39) Pregnant through IVF
40) Had pre-eclampsia / HELLP syndrome in last pregnancy.
41) I have Crohns Disease
42) I am generally in good health condition, fitness level since pregnancy very low
43) I am pescatarian
44) In the 6 months prior to becoming pregnant I didn't diet or plan to lose weight, but I made a lifestyle change mentally, foodwise, and exercise wise lost tiny bit of weight but toned a lot. During first 6 months of pregnancy I was advised to stop all exercise due to tummy/pelvic muscle discomfort
45) I have twins, one boy and one girl

46) My first pregnancy I had gestational diabetes and preeclampsia therefore had to deliver at 37 weeks in emergency cesarean. Therefore, we are interested in foods for our children to prevent diabetes.
47) Crohns disease (stable)
48) I am obese
49) I have haemochromatosis - high iron is a problem rather than low iron.
50) Prior to pregnancy I was taking Lithium for bipolar disorder and had hypothyroidism. I was also a nursing student (first year, not through Massey)
51) Diabetes clinical nurse specialist

2. Pregnancy food frequency questionnaire

2.1. Vegetables

Vegetables	Never n (%)	Most days n (%)	At least once a week n (%)	At least once a month n (%)	At least once during my pregnancy n (%)
Artichokes	402 (88%)	1 (0%)	5 (1%)	3 (1%)	47 (10%)
Asparagus	171 (37%)	17 (4%)	36 (8%)	74 (16%)	160 (35%)
Beetroot	87 (19%)	14 (3%)	56 (12%)	135 (29%)	166 (36%)
Broccoli	5 (1%)	147 (32%)	233 (51%)	56 (12%)	17 (4%)
Brussel sprouts	269 (59%)	4 (1%)	22 (5%)	66 (14%)	97 (21%)
Cabbage	47 (10%)	28 (6%)	94 (21%)	187 (41%)	102 (22%)
Capsicum, peppers	25 (5%)	128 (28%)	179 (39%)	101 (22%)	25 (5%)
Carrots	2 (0%)	248 (54%)	160 (35%)	44 (10%)	4 (1%)
Cauliflower	36 (8%)	44 (10%)	138 (30%)	166 (36%)	74 (16%)
Corn	19 (4%)	62 (14%)	155 (34%)	144 (31%)	78 (17%)
Courgette, zucchini, marrow	34 (7%)	75 (16%)	151 (33%)	148 (32%)	50 (11%)
Green beans, broad beans	28 (6%)	51 (11%)	157 (34%)	154 (34%)	68 (15%)
Kale	253 (55%)	17 (4%)	32 (7%)	75 (16%)	81 (18%)
Kumara	16 (3%)	51 (11%)	196 (43%)	153 (33%)	42 (9%)
Lettuce	17 (4%)	150 (33%)	180 (39%)	84 (18%)	27 (6%)
Cucumber	35 (8%)	134 (29%)	163 (36%)	83 (18%)	43 (9%)
Mushrooms	63 (14%)	66 (14%)	165 (36%)	117 (26%)	47 (10%)
Onions	23 (5%)	260 (57%)	132 (29%)	27 (6%)	16 (3%)
Celery	99 (22%)	18 (4%)	75 (16%)	160 (35%)	106 (23%)
Green leafy vegetables	46 (10%)	146 (32%)	149 (33%)	82 (18%)	35 (8%)
Peas	45 (10%)	66 (14%)	171 (37%)	120 (26%)	56 (12%)
Potato	3 (1%)	136 (30%)	226 (49%)	76 (17%)	17 (4%)
Pumpkin, squash	24 (5%)	32 (7%)	176 (38%)	173 (38%)	53 (12%)
Yams	294 (64%)	2 (0%)	10 (2%)	55 (12%)	96 (21%)
Radishes	296 (65%)	2 (0%)	7 (2%)	40 (9%)	113 (25%)
Spinach, silver beet	36 (8%)	102 (22%)	167 (36%)	113 (25%)	40 (9%)
Sprouted beans and seeds	255 (56%)	7 (2%)	30 (7%)	76 (17%)	90 (20%)
Tomatoes	29 (6%)	196 (43%)	173 (38%)	48 (10%)	12 (3%)

2.2. Fruit

Fruit	Never n (%)	Most days n (%)	At least once a week n (%)	At least once a month n (%)	At least once during my pregnancy n (%)
Apples	14 (3%)	206 (45%)	146 (32%)	67 (15%)	25 (5%)
Banana	28 (6%)	226 (49%)	133 (29%)	46 (10%)	25 (5%)
Kiwifruit	73 (16%)	100 (22%)	134 (29%)	103 (22%)	48 (10%)
Cherries	191 (42%)	27 (6%)	39 (9%)	56 (12%)	145 (32%)
Grapefruit	347 (76%)	6 (1%)	10 (2%)	24 (5%)	71 (16%)
Lemons	79 (17%)	43 (9%)	113 (25%)	140 (31%)	83 (18%)
Oranges, mandarins	26 (6%)	142 (31%)	145 (32%)	100 (22%)	45 (10%)
Feijoas	211 (46%)	39 (9%)	51 (11%)	51 (11%)	106 (23%)
Grapes	29 (6%)	52 (11%)	148 (32%)	156 (34%)	73 (16%)
Mango	179 (39%)	12 (3%)	37 (8%)	91 (20%)	139 (30%)
Melon	166 (36%)	16 (3%)	37 (8%)	84 (18%)	155 (34%)
Pears	92 (20%)	38 (8%)	94 (21%)	126 (28%)	108 (24%)
Pineapple	54 (12%)	29 (6%)	88 (19%)	182 (40%)	105 (23%)
Nashi pears, Chinese pears	244 (53%)	10 (2%)	18 (4%)	81 (18%)	105 (23%)
Watermelon	99 (22%)	26 (6%)	53 (12%)	107 (23%)	173 (38%)
Apricots	140 (31%)	30 (7%)	52 (11%)	96 (21%)	140 (31%)
Nectarines	106 (23%)	49 (11%)	63 (14%)	109 (24%)	131 (29%)
Pawpaw	402 (88%)	3 (1%)	0	12 (3%)	41 (9%)
Peaches	94 (21%)	39 (9%)	82 (18%)	115 (25%)	128 (28%)
Persimmon	383 (84%)	3 (1%)	14 (3%)	14 (3%)	44 (10%)
Plums	111 (24%)	33 (7%)	61 (13%)	120 (26%)	133 (29%)
Lychees	425 (93%)	0	2 (0%)	4 (1%)	27 (6%)
Avocadoes	39 (9%)	105 (23%)	144 (31%)	118 (26%)	52 (11%)
Olives	197 (43%)	27 (6%)	61 (13%)	104 (23%)	69 (15%)
Rhubarbs	284 (62%)	2 (0%)	9 (2%)	53 (12%)	110 (24%)
Tamarillos	388 (85%)	2 (0%)	6 (1%)	15 (3%)	47 (10%)
Fruits salad (canned)	247 (54%)	9 (2%)	27 (6%)	68 (15%)	107 (23%)
Berries	7 (2%)	148 (32%)	151 (33%)	104 (23%)	48(10%)
Sultana’s, raisins, currants, figs	87 (19%)	68 (15%)	87 (19%)	113 (25%)	103 (22%)
Dried apricots, prunes, dates, mixed dried fruit	69 (15%)	85 (19%)	98 (21%)	115 (25%)	91 (20%)

2.3. Protein

Meat	Never n (%)	Most days n (%)	At least once a week n (%)	At least once a month n (%)	At least once during my pregnancy n (%)
Red meat	30 (7%)	189 (41%)	201 (44%)	23 (5%)	15 (3%)
Poultry	26 (6%)	230 (50%)	165 (36%)	26 (6%)	11 (2%)
Oily fish	97 (21%)	21 (5%)	157 (34%)	128 (28%)	55 (12%)
White fish	59 (13%)	2 (0%)	131 (29%)	194 (42%)	72 (16%)
Crustaceans	261 (57%)	1 (0%)	21 (5%)	78 (17%)	97 (21%)
Mollusks	329 (72%)	1 (0%)	2 (0%)	36 (8%)	90 (20%)
Legumes	87 (19%)	52 (11%)	117 (26%)	122 (27%)	80 (17%)
Nut or nut butters	13 (3%)	211 (46%)	141 (31%)	72 (16%)	21 (5%)
Seeds	58 (13%)	126 (28%)	129 (28%)	95 (21%)	50 (11%)
Tofu	310 (68%)	8 (2%)	22 (5%)	49 (11%)	69 (15%)

2.4. Breads and cereals

Grains	Never n (%)	Most days n (%)	At least once a week n (%)	At least once a month n (%)	At least once during my pregnancy n (%)
Breads	2 (0%)	376 (82%)	70 (15%)	8 (2%)	2 (0%)
Breakfast cereals	35 (8%)	273 (60%)	86 (19%)	45 (10%)	19 (4%)
Rice, pasta, noodles	4 (1%)	194 (42%)	226 (49%)	29 (6%)	5 (1%)
Other grains	75 (16%)	32 (7%)	133 (29%)	147 (32%)	71 (16%)
Wholegrain versions of above	30 (7%)	182 (40%)	134 (29%)	64 (14%)	48 (10%)

2.5. Dairy

Dairy	Never n (%)	Most days n (%)	At least once a week n (%)	At least once a month n (%)	At least once during my pregnancy n (%)
Low fat cow's milk	229 (50%)	113 (25%)	43 (9%)	24 (5%)	49 (11%)
Full fat cow's milk	79 (17%)	258 (56%)	63 (14%)	31 (7%)	27 (6%)
Non fortified milk alternatives	275 (60%)	49 (11%)	29 (6%)	32 (7%)	73 (16%)
Calcium fortified milk alternatives	302 (66%)	38 (8%)	25 (5%)	27 (6%)	66 (14%)
Yoghurt (plain, unsweetened)	82 (18%)	147 (32%)	99 (22%)	68 (15%)	62 (14%)
Yoghurt (flavoured)	99 (22%)	90 (20%)	103 (22%)	89 (19%)	77 (17%)
Ice cream	20 (4%)	34 (7%)	164 (36%)	186 (41%)	54 (12%)
Strong flavoured cheeses	84 (18%)	66 (14%)	142 (31%)	109 (24%)	57 (12%)
Mild flavoured cheese	73 (16%)	53 (12%)	140 (31%)	123 (27%)	69 (15%)
Cream cheese, cheese spread	114 (25%	25 (5%)	78 (17%)	136 (30%)	105 (23%)

2.6. Other food items

Other	Never n (%)	Most days n (%)	At least once a week n (%)	At least once a month n (%)	At least once during my pregnancy n (%)
Brown seaweed	343 (75%)	2 (0%)	11 (2%)	37 (8%)	65 (14%)
Green or red seaweed	312 (68%)	1 (0%)	17 (4%)	56 (12%)	72 (16%)
Garlic	11 (2%)	236 (52%)	162 (35%)	41 (9%)	8 (2%)
Ginger	33 (7%)	76 (17%)	186 (41%)	129 (28%)	34 (7%)
Onion	20 (4%)	272 (59%)	123 (27%)	31 (7%)	12 (3%)
Chilli	90 (20%)	41 (9%)	156 (34%)	117 (26%)	54 (12%)
Curry (powder or paste)	51 (11%)	12 (3%)	128 (28%)	189 (41%)	78 (17%)
Wasabi	345 (75%)	1 (0%)	8 (2%)	34 (7%)	70 (15%)
Herbs	28 (6%)	101 (22%)	178 (39%)	117 (26%)	34 (7%)
Salad dressing	91 (20%)	67 (15%)	145 (32%)	108 (24%)	47 (10%)
Other herbs, spices and dressings Apple cider vinegar, olive oil, siracha, aioli, sesame, vinegars, coriander, turmeric, paprika, red curry paste, mayonnaise, hot sauce, cumin, mint, soy sauce, turmeric, BBQ sauce, basil, Indian spices, pepper, gravy, chives	403 (88%)	23 (5%)	14 (3%)	9 (2%)	9 (2%)
Sugar (including honey)	50 (11%)	155 (34%)	142 (31%)	71 (16%)	40 (9%)
Salt (non-iodised)	212 (46%)	127 (28%)	59 (13%)	19 (4%)	41 (9%)
Salt (Iodised)	51 (11%)	269 (59%)	91 (20%)	24 (5%)	23 (5%)
Pepper	31 (7%)	317 (69%)	77 (17%)	24 (5%)	9 (2%)
Other seasoning Nutritional yeast, stevia, chilli, olive oil, stock, maple syrup, sweetener	427 (93%)	13 (3%)	10 (2%)	2 (0%)	6 (1%)
Cakes, slices, muffins	6 (1%)	86 (19%)	253 (55%)	99 (22%)	14 (3%)
Biscuits	14 (3%)	101 (22%)	207 (45%)	111 (24%)	25 (5%)

2.7. Beverages

Beverages	Never n (%)	Most days n (%)	At least once a week n (%)	At least once a month n (%)	At least once during my pregnancy n (%)
Water	0	451 (98%)	5 (1%)	1 (0%)	1 (0%)
Fruit juice	34 (7%)	82 (18%)	146 (32%)	126 (28%)	70 (15%)
Complan, sustagen	420 (92%)	11 (2%)	11 (2%)	5 (1%)	11 (2%)
Hot chocolate, drinking chocolate, cocoa, ovaltine, Nesquik, milo	81 (18%)	71 (16%)	141 (31%)	95 (21%)	70 (15%)
Tea	83 (18%)	222 (48%)	87 (19%)	44 (10%)	22 (5%)
Coffee	156 (34%)	193 (42%)	57 (12%)	24 (5%)	28 (6%)

2.8. Flavour preferences

	Strongly agree n (%)	Agree n (%)	Somewhat agree n (%)	Neither agree nor disagree n (%)	Somewhat disagree n (%)	Disagree n (%)	Strongly disagree n (%)
Sweet tooth	118 (26%)	115 (25%)	44 (10%)	41 (9%)	106 (23%)	20 (4%)	14 (3%)
Savoury palate	66 (14%)	102 (22%)	54 (12%)	83 (18%)	121 (26%)	27 (6%)	5 (1%)

2.9. Additional comments

1) Energy drinks were also consumed
2) With terrible morning sickness I preferred sweet soft foods over drier foods like nuts etc.
3) I had bad food aversions. Most of the foods I liked to eat before being pregnant suddenly made me feel very sick. I also had bad reflux and found milk helped somehow even though before pregnancy milk made me feel sick. During pregnancy it had the opposite effect. I mainly ate white processed foods due to the fear of harming my fetus by eating something fresh that could harm it.
4) Everything I ate was vegan and gluten free
5) The thought of vegies made me nauseated in the first and part of the second trimester
6) Celiac
7) Sugar free option taken when available
8) I was borderline pregnancy diabetics so has to watch what I ate in the 3rd trimester onwards.
9) What my body wants is very different second time round!

10) I do have some food allergies that dictate what fruits I can eat
11) I craved sweet foods with this baby but Savoury foods with my first baby.
12) I have been drinking McDonalds shakes
13) When a fruit I like e.g. feijoa or cherries is in season then I will eat it every day. I try to eat vegetables seasonally as well so some questions I was unsure how to answer
14) Before I got pregnant I only ate paleo foods once I got pregnant I had severe nausea and the food I was eating was not supplying me with enough carbs or energy. My midwife requested me to change and eat more carb foods rice, pastas and bread. I refused until I lost so much weight and energy, I started eating this food which dramatically changed my bodies taste buds and Gave me a fighting chance against my morning sickness (more like /4/7 sickness) I had this till we reached 16weks pregnant
15) My food intake was higher with this pregnancy than previous pregnancies due to being pregnant with twins
16) About 6 months before I fell pregnant I was gluten free and ate mostly meat, veggies and fruit but since becoming pregnant I have found myself eating a lot of gluten and making poor food choices. I have noticed a huge difference in my energy levels and mood which I think is because of the food I am eating
17) food plan in place due to GDM
18) I tried to follow all govt recommendations about which foods to avoid in pregnancy
19) My food and drink choices have been largely affected by the fact that I have had hyperemesis gravidarum for both of my pregnancies. This meant that I have mostly eaten whatever I can stomach, or whatever I can keep down.
20) I ate a lot of fruit and vegetables but feel the survey answers don't allow for that. I tend to eat what's in season/affordable so over the 9 months it changed a lot
21) Completely went off coffee and found that I preferred sweeter things rather than Savoury
22) I have tended towards higher carbohydrate and sweeter foods during pregnancy
23) I eat what fruit and vegetables that are in season.
24) When I was nauseas and vomiting in the first trimester I lived on dry crackers for a couple of weeks. Since then it's been pretty normal. I also take a wide range of vitamins and minerals
25) Smoked salmon sushi from supermarket after 32 weeks.
26) Diet has included more meat and carbohydrate than usual, due to cravings and nausea
27) My IBS seemed to get better so I embraced wheat and lactose as I couldn't have them before pregnancy!
28) First trimester was completely different as couldn't stand most foods I loved at that time (bacon, eggs, coffee, veggies).
29) Driven by what kids want to eat most of the time, which is a bit more sweets than I want.
30) Most of the food was determined by season rather than my personal preference
31) Mostly smoothies as eating was a challenge during pregnancy due to hyperemesis.. lots of organic fruit and vegetables
32) I tried to eat as healthy as possible, the national food guidelines were helpful, I was surprised by the amount of food restrictions due to listeria risk. I found I felt much hungrier throughout my pregnancy. I did not have any food cravings.
33) Very high sugar in take (what baby craved) practically perfect GD test.

34) I vomited a lot in late pregnancy, regardless of what I ate
35) I had hyperemesis. So, anything I ate was a gamble.
36) Allergic to onions, garlic and eggs. I lived and managed a hotel/pub for a period of time during my pregnancy, so food was readily available. I also lived alone fulltime in a motorhome during the last part of my pregnancy so due to space and facilities meals were quite simple.
37) Eat a lower carb diet to help with general wellbeing and moods
38) They change throughout pregnancy e.g. coffee and sweet tooth have just started, salty prior. Depends on morning sickness..
39) Have much more of a sweet tooth with this pregnancy (girl) than previous pregnancy (son)
40) Struggled with nausea and therefore couldn't eat as health as usually would. A lot of the time could only eat plain toast and pasta.
41) I don't think my food choices change dramatically during pregnancy; we usually try to eat a good balanced diet as a family.
42) I was very nauseous in my first trimester, so I ate a lot of citrus fruit and porridge and muesli. I couldn't stand cooked food particularly meat. I came right halfway through my pregnancy
43) This 3rd pregnancy if found I wasn't grabbing healthy snacks like other pregnancies was easier and faster to get easy food snacks which wouldn't be the healthiest choice
44) Much to my shame I relied on Powerade a lot with the occasional L&P
45) I am not a chocolate person but when I am pregnant I am.
46) I ate far too much ice cream and chocolate, but other than that ate a reasonably healthy diet.
47) More of a sweet tooth during pregnancy than ever before.
48) I was very tired and found I craved sweet foods more often
49) Highly different to normal food patterns. Carbs and bakery type items feel "safe" to eat i.e. I won't throw them up, I usually eat lots of veggies, salads and meat
50) Awful morning sickness so ate when and what I could manage
51) I had severe morning sickness, so my choices were more about making it through the day than being healthy for the first 5 months
52) Pre-pregnancy I mainly ate a vegetarian (pescatarian) diet as my husband is a vegetarian. I have been trying to increase my consumption of meat since becoming pregnant.
53) I was borderline gestational diabetes so from that point made a conscious effort to eat less sugar and cut out sweet foods completely
54) I've made an effort to follow both pregnancy safety guidelines for food (i.e. avoiding shellfish and unpasteurised dairy) and to eat healthier
55) I had an extremely limited diet until 26 weeks due to morning sickness then tried hard to eat a variety of foods to make up for it
56) Can be challenging to find "safe" foods while eating out - often choices are limited.
57) As we live on a dairy farm we a garden, we try to eat seasonally. Additionally, being pregnant in Summer this time feels like I'm making different choices to my last pregnancy...
58) I'm normally a sweet tooth but this pregnancy I am favoring Savoury food

59) I am fructose free due to health reasons so any sweet food I consume are either sweetened with natural options or are my own baking without sugar or sugar substitutes
60) I make 90% of the family food from scratch, all biscuits and cakes are made at home, I make all porridge daily for myself and children.
61) Vegetables became very unappealing, whereas before I was pregnant I was eating them almost every day
62) I am pregnant with boy/girl twins
63) It is difficult to buy vegetables that are considered "safe" especially bagged salads. Fruit has been in season and therefore a lot cheaper than other varieties. Vegetables can be expensive
64) Tried to eat as healthy as I could afford. I craved red meat and mushrooms so ate a lot of those
65) I also had good quality bone broth daily
66) I have been vegetarian for 7 years and only during this pregnancy have I decided to eat chicken once a week and red meat once a month, for protein and iron for my baby. My diet is mostly tofu, vegetables and whole grains!
67) refined sugar free, gluten free
68) Really bad morning sickness, mainly ate Nando's chicken wrap extra hot. Hated anything fried
69) I tend to crave more 'unhealthy food' during pregnancy than I normally do-pies, chips, chocolate
70) Tea is decaf tea and coffee is one a day
71) Never ate anything considered to be a 'risk' food for pregnant women
72) I had GDM so I was restricted for half of my pregnancy. SO, my food choices changed a lot.
73) As I'm in my first trimester, my diet is completely different from pre-pregnancy diet. I hope that when I feel better it returns. Currently I'm eating mainly white, carbohydrate foods and hardly any fruit or veg. I struggle to find anything I feel like eating.
74) The meat I eat is mostly wild venison or pork and home killed beef
75) I was vegan throughout my pregnancy
76) I usually have a Savoury palette but in both pregnancies my preference became sweeter foods
77) I strictly adhered to the food safety guidelines
78) I am dairy, egg and nut free for the third trimester
79) I have eaten relatively healthy this pregnancy but have gained 30kg
80) Just eating less of everything so far. Low appetite.
81) I normally have a huge sweet tooth but vomited every day and craved more Savoury
82) This was the first pregnancy I did not have specific cravings and had periods of no desire to eat. It was depressing for me at times. I love food.
83) I was in Vietnam for 7 months of my pregnancy
84) I only feel sick in my pregnancy after eating deep fried food
85) I tried to reduce my sugar intake as much as possible due to gestational diabetes
86) Tying to eat lower carb to help with diabetes during pregnancy
87) Diet changed to no sugar and carb counting due to gestational diabetes. This strict diet started from 28 weeks

88) They are very different from pre pregnancy. Craving junk food, put off by healthy food!
89) I have been craving a lot of chocolate!
90) While I never had a sweet tooth, I definitely ate more sweet food than usual during my pregnancy.
91) I know I should be eating better but time hormones exhaustion has me reaching for something easy
92) I've only had a sweet tooth since being pregnant this time. I've always preferred Savoury, even in my first pregnancy
93) Broccoli made me feel sick during pregnancy. Oranges and orange juice were my biggest craving throughout.
94) I felt aversion to most sweet foods during most of the first two trimesters of pregnancy, except for Keri kitchen Orange Juice, which became a big craving for me
95) ate less red meat during pregnancy
96) Sushi once a fortnight
97) Diet controlled GDM so try and be very healthy plus vegetarian
98) I had hyperemesis so struggled to eat a lot. Found sweet food helped. Also drank lemonade to help with hydration. Was in hospital for dehydration.
99) Wanting to eat more sweet foods since becoming pregnant
100) First trimester nausea caused a big change in my food choices - fewer veggies and more salty carbs
101) Ate less pasta and sugar foods when diagnosed with GD
102) I would normal eat a lot more soft cheese, salmon, shellfish and coffee. Also, usually a lot less juice.
103) I'm vegetarian
104) I've been craving strong cheese and pickled things (olives, beetroot gherkins). In the last three weeks my milk intact was insane, approx. 1L every 2-3 days. Other fluid also increased but not as noticeably. Usually drink 2-3L water a day.
105) I am very relaxed about it
106) Choosing healthy safe foods was a major challenge for me. Time was an issue with a toddler, so food choices moved down the priority list
107) I had a sweet tooth before I was pregnant but it's the opposite now
108) I have hyperemesis gravidarum which means I'm very restricted in what I can tolerate without vomiting
109) Tried to stay low carb / low sugar high fat during pregnancy
110) Have craved a wide variety of fruit and veg. I fill up on those, then add grains and proteins on top as I feel like them. Have eaten more cheese scones this pregnancy than I have in the last 5 years!
111) I only drink decaf coffee and herbal tea. The sugar cravings this pregnancy have been horrific, especially for chocolate in all forms
112) I have drunk decaf tea and coffee all pregnancy. Also, my husband has some food allergies therefore I don't consume those foods unless we are in a restaurant and we order separately. Which is not very often!
113) Mainly dictated by level of sickness in first 5 months!
114) Fruit intake based on seasonal availability
115) Coke

116) My food choices changed after the gestation diabetes set in. Before then I had bread and jam for breakfast. I managed the diabetes by food and exercise until delivery. I walked after every meal for about 10 minutes
117) I read up on the rules around foods and drinks to avoid while pregnant and I stuck to those rules. I didn't break them, so my meat was well done rather than my preference of rare/medium and no sushi. I also mostly cut out drinking
118) Hated garlic and smell of meat.
119) I spent the first trimester vegan but then relaxed and became vegetarian. Over the last month (roughly) I began to eat a small amount of fish.
120) I definitely favored Savoury type foods during the first two trimesters, switching a little too sweet by the end.
121) I was very sick in the last 20 weeks and had anti-nausea meds the whole pregnancy
122) GDM
123) My tastes have changed hugely during pregnancy and I seem to have a lot of aversions to food I would normally eat.
124) I went off quite a few foods in early pregnancy, but this got better after 18 weeks
125) I ate A LOT sweeter foods during pregnancy
126) Although I'm not pescatarian, I generally followed this diet throughout my pregnancy because my husband is pescatarian.
127) I consume 1 energy drink weekly. Which I know is NOT recommended.
128) Have gone off tea, have craved more fresh juice and slightly more of a sweet tooth than when not pregnant.
129) Coconut nut water
130) Because I was getting a lot of heart burn I found that I avoided eating anything that was to acidic like tomatoes etc. I also found that I got less heart burn by limiting my gluten intake so stayed away from bread etc. as much as possible or used gluten free substitutes.
131) I drank Sprite
132) Carbonated drinks & chocolate especially have me reflux
133) I had a strong aversion to red meat in the first 4 months and avoided most spices due to heartburn.
134) I probably indulged myself in fast food a little more than I should have, but for the most part I tried to eat a healthy range of foods, without too much added sugar or salt.
135) I think I was mildly paranoid about what I consumed and the impact it could have on my baby, so was quite strict about what I could and couldn't have
136) Differed on season and semester.
137) mostly vegetarian
138) re previous question - I prefer savory in the morning and when I'm hungry and prefer sweet in the afternoon / night
139) Due to HG it was very difficult eating and I lost a lot of weight due to severe food problems
140) Cohn's disease can affect what I eat, I need to moderate fibre so I do not eat as many wholegrains or raw fruit and vegetables as I would like

141) Many vegetables/fruits you asked about have been out of season. Morning sickness and pregnancy food aversions make it very difficult to eat the same amount of fresh foods that were normal pre-pregnancy. Pregnancy diet restrictions/precautions e.g. not eating bagged salad/salads from garden have resulted in me eating much less salad than I would like, just to be on the safe side.
142) It is a lot easier to make healthier choices while pregnant as I have someone else (belly babe) to factor in as well
143) I don't like spicy food.
144) I eat what I want and do not sway from foods eaten when not pregnant
145) Very much changed from sweet pre pregnancy to craving Savoury foods more.
146) I felt like a lot of fresh foods as it was summer, made conscious effort to drink herbal teas and avoid shellfish
147) Have not changed my diet apart from cutting out usual unsafe foods
148) It was a very hot summer wouldn't normally eat ice cream that much
149) Didn't have coffee in the first 8 weeks (had it daily after that). Had fruit teas daily throughout pregnancy. Had caffeinated tea about 1x week.
150) I had gestational diabetes so from 27 weeks I was on a diabetes diet
151) Don't normally like onions but really like them in nearly everything!
152) I craved pineapple, grapes, avocado and cheese and ate a lot of these
153) I have been sugar free since getting diagnosed with gestational diabetes in my first pregnancy, which ruined food/baking for me So I'm very careful to make sure it won't happen again.
154) Mostly gluten free, ate paleo bread. No white flour etc. Low sugar only used natural sugars like coconut sugar. Raw slices, occasionally had chocolate but generally low carb and low sugar
155) Allergic to kiwifruit and don't drink any caffeine ever regardless of pregnancy or not.
156) Stopped consuming all dairy at 36weeks
157) Didn't eat much in first trimester due to HG - nausea and vomiting, was on medication
158) have drunk Cola to combat low blood pressure (as advised)
159) My weakness was definitely fruit. It craved it and was able to keep it down during the first trimester
160) Craved salt
161) Eaten more sweet foods towards the end of pregnancy
162) I never used to enjoy sweet foods but since being pregnant, I am all about it!
163) We have an eat free household as my eldest is very allergic to egg.
164) Heavily influenced by morning sickness for first half of pregnancy
165) Now craving more sweet foods now that I'm 6 months pregnant
166) Throughout my pregnancy I suffered from hyperemesis. This. Meant I could vomit 10 plus times a day. While I wanted to eat a healthy diet for me and baby. The healthy food. Often didn't stay down. On the days I was suffering badly I stick to eat. Small amounts of bland food. I ate plain toast, water crackers and roast. Potatoes just to have something in my stomach..
167) Kept to foods that should be avoided during pregnancy.
168) My main changes were to reduce caffeine and increase grains

169) My diet changed through the pregnancy once I had been diagnosed with gestational diabetes. Became very low sugar. Recorded all my meals (but not snacks) and blood tested after every meal

170) My palate changed from Savoury too sweet during pregnancy and has continued to be sweet during breastfeeding. While I had no strong cravings, I did find myself skipping the crisps and eating significantly more chocolate.

3. Pregnancy food choices questionnaire

3.1. Reasoning for food and drink avoidance

Reasoning for food and drink avoidance	Pregnant n (%)	Infant less than six months postpartum n (%)	Total n (%)
Following New Zealand pregnancy and breastfeeding guidelines	138 (93%)	206 (85%)	344 (88%)
Health professional's advice	100 (67%)	167 (69%)	267 (68%)
Food safety concerns	106 (71%)	161 (67%)	267 (68%)
Advice from internet, magazine, book, or newspaper	57 (38%)	82 (34%)	139 (36%)
Advice from family member or friend	41 (28%)	63 (26%)	104 (27%)
Dislike foods and drinks	30 (20%)	48 (20%)	78 (20%)
Causes nausea or vomiting	12 (8%)	25 (10%)	37 (9%)
Allergy or food intolerance	8 (5%)	12 (5%)	20 (5%)
Religion or belief	3 (2%)	9 (4%)	12 (3%)
Other: they don't fit into my diet (vegan, vegetarian, wholefoods), alcohol is harmful to an unborn child (its harmful full stop), common sense (avoided anything that could potentially have risks, from my education	10 (7%)	16 (7%)	26 (7%)

3.2. Reasoning for foods being added or increased

Reasoning for foods being added or increased in the diet	Pregnant n (%)	Infant less than six months postpartum n (%)	Total n (%)
To increase dietary iron and/or calcium	59 (50%)	98 (53%)	157 (52%)
Food cravings	56 (48%)	91 (49%)	147 (49%)
For baby's health	46 (39%)	94 (51%)	140 (46%)
Following NZPBG	29 (25%)	49 (26%)	78 (26%)
Health professional's advice	24 (21%)	41 (22%)	65 (21%)
Advice from internet, magazine, book, or newspaper	11 (9%)	23 (12%)	34 (11%)
Advice from family member or friend	6 (5%)	23 (12%)	29 (10%)
Other Hopefully so that baby doesn't get allergies, hunger, milk eased acid reflux, to be healthier, nutritionists/ dietitian's advice, own knowledge, helped nausea, heard increasing water helps with stretch marks, cravings, easy snacks	10 (9%)	16 (9%)	26 (9%)

3.3. Reasoning for food and drink limitation

Reasoning for foods being limited in the diet	Pregnant n (%)	Infant less than six months postpartum n (%)	Total n (%)
Mercury content in fish	53 (35%)	71 (35%)	124 (35%)
Dislike these foods	51 (34%)	74 (36%)	125 (35%)
Iodine content in seaweed	11 (7%)	10 (5%)	21 (6%)
Cadmium content in oysters and scallops	8 (5%)	13 (6%)	21 (6%)
Other Afraid of food poisoning, nausea, graves' disease so avoided iodine, guidelines around fish and pregnancy	13 (9%)	12 (6%)	25 (7%)

3.4. Additional comments

1) Second child, so information wasn't needed this time. Have also had gastric sleeve 7 years ago
2) I also limited coffee to one or two a week. I ate mainly white processed food as I was afraid of eating something fresh that could harm my baby. I also avoided rice and mung beans as I read on the internet not to have them. I found it really hard to eat out as I found food was always unsafe. For example I ordered a mocktail at a high tea party and they put raw egg in it even though it wasn't listed on the menu. I also was

served homemade aioli regularly. I always acknowledge to waiters that I was pregnant but none of them ever seemed to have any idea what that meant as to what I could and couldn't eat. I found this frustrating and would love it to be a part of the food hygiene training.

3) My baby was small for gestational age, so born small.
4) I have had severe morning sickness and acid reflux
5) I tried to eat as varied vegetarian diet as I could, and other than having low iron, I had no other issues during my pregnancy.
6) I lost weight the entire pregnancy
7) This pregnancy is a result of IVF after years of infertility. Anxiety related to this may have caused me to be even more cautious that I might have been otherwise.
8) I attended antenatal during another pregnancy
9) I ate sushi after 33 weeks during pregnancy.
10) Antenatal classes start next month
11) I have not started my prenatal classes
12) Used antenatal classes and advice on food from midwife in first pregnancy
13) My education re foods/drinks to consume/avoid was done in previous pregnancy
14) No antenatal classes as did it with my first child
15) Will be attending Antenatal classes shortly, just haven't yet! Booked for 2 weeks' time!
16) Extremely straightforward pregnancy with no concerns.
17) attended classes for first pregnancy two years ago so didn't opt to go this time
18) I attended a multiples specific antenatal class
19) Had 3 months of acupuncture before getting pregnant. Had 7 miscarriages. MTHFR
20) Second pregnancy so was a little more relaxed regarding food questions this time
21) I also used the MPI food safety guidelines
22) Had gestational diabetes so followed strict diet
23) Craved orange juice
24) GDB and vegetarian
25) Spoke to a nutritionist whilst in hospital for hyperemesis who helped me to identify foods I could eat which might help
26) Going to be doing antenatal, just hasn't started yet
27) 2nd pregnancy/baby. Most of the food/Nutrition advice I got was for first pregnancy and from my GP
28) I do my own research across multiple sources and seek evidence in studies rather than just believing what I'm told by one person
29) Foods that I limited question - I don't eat a huge amount of them anyway, so feel no need to limit beyond my normal diet
30) I am probably the healthiest I've been for a long time. Good moderate eating and regular exercise until week35, when I became too round.
31) Have not attended antenatal yet but enrolled
32) Antenatal classes start next month
33) I have eaten smoked salmon but it has been cooked on a pizza all homemade
34) Pre-eclampsia induced at 38 weeks, bilateral carpal tunnel and bilateral de quervains syndrome, prolapsed disc in l4/l5 minimal weight gain
35) GDM

36) I chose to do online antenatal class from empowered parenthood as there was no room in the antenatal classes until 2 weeks before my due date. My baby came 1 week early so I wouldn't have attended the class
37) Second pregnancy so didn't do antenatal course. I did with my first
38) I believe the guidelines around food/drink in pregnancy are emphasised too much, are potentially outdated/risks overstated and there should be more focus on general healthy eating. I believe women are smart enough to make their own decisions, so should not be told what and what NOT to do/eat/drink, but guided by up to date, evidence based information. This is how I have approached both of my pregnancies, especially my second one.
39) Every pregnancy is an individual journey
40) I didn't eat very well
41) I had no real cravings other than fresh fruit and soda water
42) Very swollen feet towards the end lots of heart burn
43) This pregnancy was planned, so I was taking folic acid and eating well before conception.
44) I was diagnosed with gestational diabetes at 36 weeks, so my diet changed quite dramatically then to be very careful about what I was eating, essentially avoiding 'white' foods e.g. rice, bread, potatoes
45) Hard to know which guidelines to follow - e.g. New Zealand eating guidelines differ on some things to UK/USA guidelines on foods which are safe/to avoid. It's hard to get all the nutrients you think you need for a healthy pregnancy when you have bad morning sickness and food aversions. You are just happy to eat something that doesn't make you feel sick.
46) Attended refresher breastfeeding class only
47) I drank lots of ginger tea to help with nausea recommended by friends
48) a lot of the foods and things listed I didn't avoid they just aren't available to me for cost reasons or season, or just not something I usually consume any way
49) This is my 3rd pregnancy
50) I spent a week in japan which expanded the range of foods eaten, especially seaweed/fish
51) I had a very healthy pregnancy, with no issues. Baby was born healthy too at 41 weeks.
52) I intend to attend antenatal classes in October.
53) Was high risk until discharged from MFM dept at Wellington hospital back to LMC midwife.
54) I lost weight during pregnancy. I saw an endocrinologist to discuss treatment for hypothyroidism, he thought it was most likely caused by taking lithium for a few years prior so when I stopped my thyroid began to function better. My LMC monitored my weight ad wasn't concerned
55) I'm under MOH weight gain target so far
56) Still early days only 11 weeks and so affected by terrible morning sickness
57) Second time pregnant and therefore do not reach out for information as remembered from last time.
58) Symptoms this time round are completely different to my first time 8 years ago
59) Avoided Elevit as 1st baby was born with soft cleft palate and heard numerous accounts of people taking this their baby had tongue or lip ties

60) Smooth pregnancy, minor morning sickness only, no particular food cravings or aversions
61) I had gestational diabetes so gained advice from the diabetes clinic at Auckland hospital. Low sugar diet to control diabetes but no further medications required.

4. Lactation food frequency questionnaire

4.1 Vegetables

Vegetables	Never n (%)	Most days n (%)	At least once a week n (%)	At least once a month n (%)	At least since giving birth n (%)
Artichokes	276 (95%)	1 (0%)	9 (3%)	1 (0%)	3 (1%)
Asparagus	165 (57%)	3 (1%)	81 (28%)	29 (10%)	12 (4%)
Beetroot	74 (26%)	16 (6%)	111 (38%)	78 (27%)	11 (4%)
Broccoli	7 (2%)	103 (36%)	133 (46%)	33 (11%)	14 (5%)
Brussel sprouts	204 (70%)	5 (2%)	17 (6%)	33 (11%)	31 (11%)
Cabbage	57 (20%)	17 (6%)	77 (27%)	90 (31%)	49 (17%)
Capsicum, peppers	18 (6%)	100 (34%)	102 (35%)	48 (17%)	22 (8%)
Carrots	2 (1%)	174 (60%)	92 (32%)	15 (5%)	7 (2%)
Cauliflower	43 (15%)	40 (14%)	81 (28%)	85 (29%)	41 (14%)
Corn	28 (10%)	47 (16%)	95 (33%)	80 (28%)	40 (14%)
Courgette, zucchini, marrow	34 (12%)	53 (18%)	102 (35%)	67 (23%)	34 (12%)
Green beans, broad beans	35 (12%)	44 (15%)	106 (37%)	64 (22%)	41 (14%)
Kale	183 (63%)	11 (4%)	25 (9%)	35 (12%)	36 (12%)
Kumara	18 (6%)	41 (14%)	134 (46%)	75 (26%)	22 (8%)
Lettuce	9 (3%)	105 (36%)	113 (39%)	46 (16%)	17 (6%)
Cucumber	32 (11%)	96 (33%)	92 (32%)	52 (18%)	18 (6%)
Mushrooms	51 (18%)	38 (13%)	104 (36%)	71 (24%)	26 (9%)
Onions	14 (5%)	148 (51%)	95 (33%)	20 (7%)	13 (4%)
Celery	94 (32%)	21 (7%)	46 (16%)	83 (29%)	46 (16%)
Green leafy vegetables	24 (8%)	104 (36%)	84 (29%)	52 (18%)	26 (9%)
Peas	35 (12%)	47 (16%)	108 (37%)	60 (21%)	40 (14%)
Potato	4 (1%)	98 (34%)	140 (48%)	38 (13%)	10 (3%)
Pumpkin, squash	29 (10%)	34 (12%)	108 (37%)	91 (31%)	28 (10%)
Yams	254 (88%)	1 (0%)	8 (3%)	15 (5%)	12 (4%)
Radishes	223 (77%)	2 (1%)	7 (2%)	20 (7%)	38 (13%)
Spinach, silver beet	19 (7%)	85 (29%)	97 (33%)	59 (20%)	30 (10%)
Sprouted beans and seeds	159 (55%)	8 (3%)	26 (9%)	42 (14%)	55 (19%)
Tomatoes	20 (7%)	112 (39%)	116 (40%)	34 (12%)	8 (3%)

4.2 Fruit

Fruit	Never n (%)	Most days n (%)	At least once a week n (%)	At least once a month n (%)	At least since giving birth n (%)
Apples	24 (8%)	87 (30%)	107 (37%)	42 (14%)	30 (10%)
Banana	19 (7%)	134 (46%)	77 (27%)	34 (12%)	26 (9%)
Kiwifruit	77 (27%)	60 (21%)	72 (25%)	47 (16%)	34 (12%)
Cherries	194 (67%)	10 (3%)	12 (4%)	21 (7%)	53 (18%)
Grapefruit	251 (87%)	3 (1%)	2 (1%)	10 (3%)	24 (8%)
Lemons	69 (24%)	32 (11%)	89 (31%)	57 (20%)	43 (15%)
Oranges, mandarins	34 (12%)	66 (23%)	93 (32%)	69 (24%)	28 (10%)
Feijoas	141 (49%)	38 (13%)	39 (13%)	33 (11%)	39 (13%)
Grapes	46 (16%)	32 (11%)	83 (29%)	82 (28%)	47 (16%)
Mango	175 (60%)	5 (2%)	24 (8%)	36 (12%)	50 (17%)
Melon	171 (59%)	9 (3%)	19 (7%)	38 (13%)	53 (18%)
Pears	80 (28%)	28 (10%)	62 (17%)	77 (27%)	43 (15%)
Pineapple	64 (22%)	16 (6%)	49 (6%)	93 (32%)	68 (23%)
Nashi pears, Chinese pears	201 (69%)	8 (3%)	18 (6%)	28 (10%)	35 (12%)
Watermelon	119 (41%)	10 (3%)	26 (9%)	46 (16%)	89 (31%)
Apricots	156 (54%)	13 (4%)	28 (10%)	35 (12%)	58 (20%)
Nectarines	135 (47%)	24 (8%)	33 (11%)	44 (15%)	54 (19%)
Pawpaw	273 (94%)	1 (0%)	1 (0%)	6 (2%)	9 (3%)
Peaches	112 (39%)	23 (8%)	43 (15%)	49 (17%)	63 (22%)
Persimmon	252 (87%)	8 (3%)	6 (2%)	5 (2%)	19 (7%)
Plums	120 (41%)	19 (7%)	41 (14%)	43 (15%)	67 (23%)
Lychees	274 (94%)	1 0%)	0	2 (1%)	13 (4%)
Avocadoes	54 (19%)	56 (19%)	73 (25%)	58 (20%)	49 (17%)
Olives	125 (43%)	11 (4%)	47 (165)	66 (23%)	41 (14%)
Rhubarb	208 (72%)	2 (1%)	5 (2%)	23 (8%)	52 (18%)
Tamarillos	263 (91%)	2 (1%)	3 (1%)	4 (1%)	18 (6%)
Fruits salad (canned)	187 (64%)	6 (2%)	15 (5%)	36 (12%)	46 (16%)
Berries	23 (8%)	79 (27%)	96 (33%)	60 (21%)	32 (11%)
Sultana's, raisins, currants, figs	73 (25%)	41 (14%)	58 (20%)	72 (25%)	46 (16%)
Dried apricots, prunes, dates, mixed dried fruit	78 (27%)	54 (19%)	66 (23%)	53 (18%)	39 (13%)

4.3 Protein

Protein	Never n (%)	Most days n (%)	At least once a week n (%)	At least once a month n (%)	At least since giving birth n (%)
Red meat	23 (8%)	151 (52%)	106 (37%)	7 (2%)	3 (1%)
Poultry	19 (7%)	148 (51%)	108 (37%)	10 (3%)	5 (2%)
Oily fish	68 (23%)	13 (4%)	97 (33%)	78 (27%)	34 (12%)
White fish	58 (20%)	4 (1%)	94 (32%)	98 (34%)	36 (12%)
Crustaceans	143 (49%)	0	18 (6%)	63 (22%)	66 (23%)
Mollusks	183 (63%)	1 (0%)	10 (3%)	39 (13%)	57 (20%)
Legumes	52 (18%)	41 (14%)	78 (27%)	76 (26%)	43 (15%)
Nut or nut butters	12 (4%)	149 (51%)	83 (29%)	28 (10%)	18 (6%)
Seeds	46 (16%)	92 (32%)	74 (26%)	44 (15%)	34 (12%)
Tofu	215 (74%)	6 (2%)	14 (5%)	33 (11%)	22 (8%)

4.4 Breads and cereals

Grains	Never n (%)	Most days n (%)	At least once a week n (%)	At least once a month n (%)	At least since giving birth n (%)
Breads	3 (1%)	245 (84%)	30 (10%)	6 (2%)	6 (2%)
Breakfast cereals	33 (11%)	159 (55%)	50 (17%)	31 (11%)	17 (6%)
Rice, pasta, noodles	2 (1%)	122 (42%)	138 (48%)	20 (7%)	8 (3%)
Other grains	64 (22%)	24 (8%)	87 (30%)	86 (30%)	29 (10%)

4.5 Dairy

Dairy	Never n (%)	Most days n (%)	At least once a week n (%)	At least once a month n (%)	At least since giving birth n (%)
Low fat cow's milk	160 (55%)	62 (21%)	19 (7%)	14 (5%)	35 (12%)
Full fat cow's milk	69 (24%)	138 (48%)	40 (14%)	14 (5%)	29 (10%)
Non fortified milk alternatives	182 (63%)	44 (15%)	15 (5%)	17 (6%)	32 (11%)
Calcium fortified milk alternatives	201 (69%)	41 (14%)	9 (3%)	13 (4%)	26 (9%)
Yoghurt (plain, unsweetened)	82 (28%)	82 (28%)	61 (21%)	25 (9%)	40 (14%)
Yoghurt (flavoured)	104 (36%)	28 (10%)	62 (21%)	49 (17%)	47 (16%)
Ice cream	28 (10%)	24 (8%)	81 (28%)	102 (35%)	55 (19%)
Strong flavoured cheeses	47 (16%)	41 (14%)	98 (34%)	64 (22%)	40 (14%)
Mild flavoured cheese	26 (9%)	54 (19%)	107 (37%)	69 (24%)	34 (12%)
Cream cheese, cheese spread	82 (28%)	14 (5%)	66 (23%)	69 (24%)	59 (20%)

4.6 Other

Other	Never n (%)	Most days n (%)	At least once a week n (%)	At least once a month n (%)	At least since giving birth n (%)
Brown seaweed	203 (70%)	0	11 (4%)	42 (14%)	34 (12%)
Green or red seaweed	171 (59%)	1 (0%)	24 (8%)	44 (15%)	50 (17%)
Garlic	8 (3%)	140 (48%)	113 (39%)	17 (6%)	12 (4%)
Ginger	28 (10%)	62 (21%)	101 (35%)	68 (23%)	31 (11%)
Onion	17 (6%)	1*60 (55%)*	81 (28%)	18 (6%)	14 (5%)
Chilli	69 (24%)	27 (9%)	95 (33%)	66 (23%)	33 (11%)
Curry (powder or paste)	53 (18%)	14 (5%)	81 (28%)	96 (33%)	46 (16%)
Wasabi	193 (67%)	1 (0%)	11 (4%)	35 (12%)	50 (17%)
Lemon or lime	28 (10%)	62 (21%)	102 (35%)	64 (22%)	34 (12%)
Herbs	8 (3%)	153 (53%)	95 (33%)	24 (8%)	10 (3%)
Salad dressing	67 (23%)	59 (20%)	91 (31%)	49 (17%)	24 (8%)
Other herbs, spices, and dressings Pepper, olive oil, tahini, apple cider vinegar, mustard, siracha, paprika, mayonnaise, bone broth, vinegar, tomato sauce, BBQ sauce, sweet chilli, cayenne, garam masala, coriander, Indian spices, aioli, cinnamon, nutmeg	261 (90%)	13 (4%)	9 (3%)	1 (0%)	6 (2%)
Sugar (including honey)	55 (19%)	107 (37%)	72 (25%)	36 (12%)	20 (7%)
Salt (non-iodised)	147 (51%)	82 (28%)	32 (11%)	11 (4%)	18 (6%)
Salt (Iodised)	41 (14%)	166 (57%)	56 (19%)	19 (7%)	8 (3%)
Pepper	22 (8%)	201 (69%)	58 (20%)	6 (2%)	3 (1%)
Other seasoning	275 (95%)	9 (3%)	1 (0%)	1 (0%)	4 (1%)
Cakes, slices, muffins	4 (1%)	68 (23%)	157 (54%)	49 (17%)	12 (4%)
Biscuits	10 (3%)	100 (34%)	115 (40%)	45 (16%)	20 (7%)

4.7 Beverages

Beverages	Never n (%)	Most days n (%)	At least once a week n (%)	At least once a month n (%)	At least since giving birth n (%)
Water	2 (1%)	283 (98%)	3 (1%)	2 (1%)	0
Fruit juice	38 (13%)	37 (13%)	84 (29%)	87 (30%)	44 (15%)
Complan, sustagen	260 (90%)	7 (2%)	9 (3%)	9 (3%)	5 (2%)
Hot chocolate, drinking chocolate, cocoa, ovaltine, Nesquik, milo	67 (23%)	44 (15%)	75 (26%)	45 (16%)	59 (20%)
Tea	54 (19%)	136 (47%)	58 (20%)	27 (9%)	15 (5%)
Coffee	92 (32%)	146 (50%)	30 (10%)	14 (5%)	8 (3%)

4.8 Flavour preferences

	Strongly agree n (%)	Agree n (%)	Somewhat agree n (%)	Neither agree nor disagree n (%)	Somewhat disagree n (%)	Disagree n (%)	Strongly disagree n (%)
Sweet tooth	75 (26%)	76 (26%)	24 (8%)	24 (8%)	72 (25%)	11 (4%)	8 (3%)
Savoury palate	37 (13%)	62 (21%)	34 (12%)	54 (19%)	80 (28%)	19 (7%)	4 (1%)

4.9 Additional comments

1) all wholefoods plant based
2) I usually have a savoury palate but crave sweet food and junk food when pregnant and breastfeeding
3) Craving Caramel Slice
4) I try to eat seasonally so this has influenced the food choices made
5) Mixture of good and bad foods.
6) I eat a vegetarian diet
7) I have a sweet tooth and eat more sugary things than I should!
8) I eat even more now than I did when I was pregnant
9) I know I haven't made the best food choices, but I am working on that
10) Have been eating more wholegrain and fruit and veggies and less sugar not because I want to lose weight but because that's what I'm Craving
11) I live with my baby in a motorhome. Meals have to be simple and quick. I am also dairy free and have cut back on 'windy' foods quite considerably as my baby reacts badly to both.
12) Craved more savoury when pregnant, but always Normally a sweet person

13) Baby has a dairy intolerance so I did an elimination diet to identify and have added everything bar dairy back to my diet
14) Have now cut out dairy from diet for baby not confirmed issue but precaution due to reflux and colic
15) I mostly drink decaf instant coffee but will have real coffee when I'm out.
16) Easy and quick food like leftovers or carbs (noodles, pasta, toast or sandwiches)
17) My appetite has drastically decreased because of sleep deprivation and anxiety so my diet is not very normal.
18) Gluten free
19) I am consciously eating more easily digestible foods and also adding in brewer's yeast, oats and ground linseed for breastfeeding volumes
20) Much stricter on cabbage, windy foods in the early days. As baby has gotten older I am still b/feeding but I eat what I want as he is not windy. I do find I eat more calories but still trying to make healthy choices as I am quite educated in the food/beverage industry. I typically eat at home and very rarely eat out or have takeaways even more so since having a baby
21) My sweet tooth seems to have lessened.
22) I am very hungry and want carbohydrates
23) I have an allergy to seafood
24) I drink way more water (exclusively breastfeeding) and I am way hungrier than I ever have been!
25) Still refined sugar free and gluten free
26) I have been doing an elimination diet as daughter has reflux
27) I avoid certain foods due to breastfeeding such as leafy greens and spices
28) I have cut out dairy almost entirely since it seems to affect my baby's gut via breastmilk. I have cut out all brassicas completely for this reason too
29) I've eaten lots of the foods which were restricted in pregnancy, like soft cheeses, raw salmon etc
30) I have found out I have hyper thyroidism and would say I eat a lot more
31) I would normally consumer the majority of these foods but it's only been 3 weeks since I had my daughter so I've not yet had the opportunity to have some of the things I usually would have.
32) I drink Kombucha and coconut water most days in the pregnancy and since giving birth
33) I have definitely developed a craving for sweet foods
34) I choose juices and drinks with reduced or no sugar options when I can. E.g. coke no sugar or just juice 50% less sugar
35) I definitely developed a sweet tooth while pregnant and it may have stuck around while breastfeeding....
36) I decided to ditch most processed foods when my wee one was 3 months old also gluten and oats, and found she had s reaction to eggs (very dry red skin)
37) Avoiding certain foods because of suspected reflux in baby and to reduce baby's wind issues
38) My baby has dairy intolerance as well as Colic so avoiding a lot of foods for his sake
39) I've found that I'm forgetting to eat breakfast and then struggling to select food for the rest of the day. No motivation or desire to cook/eat. Not sure if it's from being too busy and tired or just that nothing is appealing at the moment

40) Some of the fruit and veggies ate just not in season.
41) Eating heaps of fruit and veg ... Occasional 3pm muffins or biscuits
42) due to reflux and health professional advice I am DF ad GF free now
43) Baby has reflux so I avoid foods that may pose a trigger
44) Have had to change diet due to babies dairy intolerance/allergy and other food sensitivities
45) Decaf coffee, changed to coconut milk due to an expected dairy intolerance with my baby
46) I still avoid sweet things, feels like it's wrong. I guess it's because of the gestation diabetes... not sure why but I deliberately avoid eating sweet stuff and I still watch my carbs...
47) I am mostly vegetarian with the allowance of some fish occasionally
48) I find it hard to prepare healthy meals due to lack of time and energy
49) Trying a be dairy free for my bubs
50) I initially was eating dairy etc but cut it out as part of trying to address my baby's discomfort
51) I have avoided onion, Capsicum, milk (as much as I could) due to impact on BF baby
52) I limit my milk intake as having milk straight (glasses of milk, or on cereal) seems to give my baby in upset stomach (gassy, more poos etc) but normal amounts of other dairy (cheese, yoghurt) seem to be fine. I use soy milk instead of cow's milk
53) I have definitely developed more of a sweet tooth since giving birth
54) resumed eating meat recently
55) Avoided cow's milk in first 8 weeks after birth and drank almond milk instead. After that drank cow's milk daily (and didn't drink almond milk anymore).
56) My previous 3 babies were extremely sensitive to dairy and fruit. This one is definitely sensitive to fruit so I don't dare try dairy. As an example, 1 apple resulted in 20 hours of non-stop screaming for my previous daughter, a single strawberry about 6 hours of screaming for my older son. My food choices are driven largely by whether I think the food is likely to upset his tummy.
57) Dairy free as baby extremely likely to be allergic. No crustaceans anymore as baby is allergic
58) Tea is generally non-caffeinated herbal teas and coffee is usually de-caffeinated (I know there is still caffeine) or instant. I keep it below 100meg on days I do have it and avoided it the first two months.
59) Have noticed I have gone right off fruit. Eating a lot of muesli bars as something quick and easy!
60) I've gone dairy free in last week to try help our wee guys tummy
61) Only 3 weeks since giving birth. A lot of seasonal fruit/vegetables not eaten yet as not in season but normally would
62) In the last 5weeks I have been recommended to omit dairy products from my diet for the health of my baby by paediatricians.
63) Limited time to cook with two kids has influenced what I eat
64) I didn't drink coffee for the first three months after birth as my midwife told me the caffeine transfers in the breastmilk and it hard for their small livers to process. Since 4 months I've had 1 cup most days
65) Less foods that create gas for baby

66) I am eating more pre-prepared, packaged and processed foods compared to previously, where I would make a lot of food from scratch. I choose the convenience of buying store varieties over home preparation at present. This would translate to higher levels of sugar, salt and preservatives than previously.
67) I mostly avoid gluten as I can react badly so bread etc is gluten free
68) Initial palate was very sweet and included craving cake, 3m on and its evening out a bit but still tending sweet.
69) Since giving birth and feeding I'm always hungry and always want something sweeter

5. Lactation food choices questionnaire

5.1 Reasoning for food avoidance

Reasoning for food and drink avoidance	Total n (%)
Following NZPBG	95 (48%)
Health professional's advice	55 (28%)
Dislike foods and drinks	51 (26%)
Food safety concerns	24 (12%)
Advice from internet, magazine, book, or newspaper	19 (10%)
Allergy or food intolerance	15 (8%)
Advice from family member or friend	12 (6%)
Religion or belief	8 (4%)
Causes nausea or vomiting	4 (2%)
Other: don't feel like consuming it, not part of normal diet, babies allergies, dietary code (vegan, vegetarian), common sense, don't need it and better for baby, baby side effects (gassy, reflux, upset, colic), forget I can have these foods now, unsure, choose not to answer	57 (29%)

5.2 Reasoning for foods being added or increased

Reasoning for foods being added or increased in the diet	Total n (%)
For baby's health	63 (42%)
To increase dietary iron and/or calcium	54 (36%)
Food cravings	43 (29%)
Health professional's advice	25 (17%)
Advice from family member or friend	22 (15%)
Following NZPBG	20 (13%)
Advice from internet, magazine, book, or newspaper	10 (7%)
Other: Increase milk production, dense energy source, improve my diet, I'm hungrier, no longer have food restrictions of pregnancy, convenient, trying to lose weight, constipation, trying to increase fibre/ protein/ carbohydrates in diet, easy, for my health, choose not to answer	35 (23%)

5.3 Reasoning for food limitation

Reasoning for foods being limited in the diet	Total n (%)
Dislike these foods	46 (25%)
Mercury content in fish	13 (7%)
Cadmium content in oysters and scallops	3 (2%)
Other Baby allergies, high-risk foods for babies, still cause nausea/ vomiting,	6 (3%)

5.4 Intended breastfeeding length

Intended breastfeeding length	Total n (%)
No longer	10 (4%)
Until baby is 3-6 months	78 (27%)
Until baby is 7-12 months	52 (18%)
Until baby is 13-18 months	25 (9%)
Until baby is 18 months or older	83 (29%)
Until baby wants to stop feeding	9 (3%)
Until I return to work	17 (6%)
Other Unsure, have not decided, medical issues may mean earlier,	9 (3%)

5.5 Reasoning for intended breastfeeding length

Reasoning for intended breastfeeding length	Total n (%)
Breastfeeding is the best source of food for baby	263 (93%)
Bond with baby	170 (60%)
Following the NZPBG	47 (17%)
Told by health professional	38 (13%)
Told by family member or friends	23 (8%)
Following internet, book, newspaper, magazine	19 (7%)
Other: Its free, handouts from health professionals, convenience, WHO recommendations, personal preference, protect baby's immunity, I enjoy breastfeeding, outgrown allergies, aid in weight loss, won't take bottle, many benefits for baby	55 (19%)

5.6 Additional comments

1) Developed a stronger sweet tooth.
2) A mix of good and bad foods

3) I eat what I feel like when I feel like
4) No box for the how long will I BF for under other. Reason is until I start next round of IVF as they won't allow BF to continue while doing that
5) I know I consume too much sugar, it's my weakness in the evenings (chocolate/ice-cream etc)
6) I can eat when and lactose which I couldn't pre pregnancy
7) I know my food choices have not been great, and I am working on that
8) I have used formula with my older child for failure to thrive so it's not that I am against it it's more that t it's more I find breast easier and it's great bonding
9) Disabled after c section couldn't prepare food
10) I feel like my diet has been similar pre during and post pregnancy
11) I try to reduce the level of dairy since as I find it give her an upset tummy.
12) cut out dairy products and windy type foods as upset baby
13) Not my diet but I forgot to mention my baby was born 4 weeks early despite me being healthy
14) Has got better since giving birth not snacking on the same snack unhealthy stuff
15) Quantity has been hardness to get right especially when baby takes up a lot of time during the day when I have no help. Breakfast and dinner are always good however middle of the day has and continues to be a struggle. My Plunket nurse is on my case about eating enough across the day. I've never really worked out how much I need
16) Can be bad at tines with more convenience and easy to prepare meals
17) I'm sure I needed a lot more help/advice with my first baby, but this one has been easy to feed. In saying that, I haven't adjusted my diet while breastfeeding for any of my children!
18) Time to eat well is very difficult. Getting a variety of foods each day is so hard with a new-born!
19) I tend to eat more when I'm tired, even though I'm not hungry - seems to give me a bit of a boost
20) It is hard to know if what you are eating is impacting your babies wind or not. I used to limit cabbage/onion in early baby days but now it doesn't seem to matter. It's also hard to know whether you are consuming more calories than you need for Breastfeeding. you are hungry all the time but that could be boredom/tiredness/comfort eating
21) Due to ineffective latch my baby has not been able to breastfeed. Had help from many midwives and a lactation consultant but wasn't able to make it work. Expressed for a few days but wasn't able to sustain that with two other children at home.
22) I'm BF twins so I'm eating every time I have the opportunity which means I eat more bread than I really want to and less salads than I want. Smoothies have been the best thing!
23) My baby has reflux so have eliminated certain food groups such as dairy
24) It's sometimes hard to find the time to eat well
25) my diet was influenced by my baby allergies and eczema
26) in relation to limiting food re fish, kelp etc on a previous page, I have not limited them I just don't eat them anyway
27) I also pump and donate my milk to another baby who needs it.
28) Poor milk supply so chosen to eat foods such as oats to increase supply.
29) If I don't eat enough before breastfeeding, I will be tired to the point of drained

30) I have purposefully chosen to eat a wide range of foods to ensure my baby is exposed to a variety of nutrients through breastmilk and to maintain my gut health especially as I was given iv antibiotics in labour and also took a course of antibiotics while breastfeeding (for mastitis).
31) Sweet tooth is much worse. sugar cravings that I didn't have during pregnancy
32) I return to work when she is 9 months so will stop breastfeeding by then
33) Being so limited with what baby can tolerate (E.g. no dairy, soy, caffeine...) and what I can have (being Coeliac) my diet is very limited so my challenge is finding foods I can have and eating enough to keep up energy and supply
34) My baby is rather gassy but I am confused as to if my diet is any cause
35) Gone back to eating everything I did pre pregnancy, except alcohol
36) Was told to go DF/GF to help my baby. This has helped him but wish I had more support than when told to stop eating this and that was that
37) I believe something in my diet is effecting my baby but not yet identified- likely dairy
38) Limited dairy, nuts, eggs alternatively to try and rule out an intolerance
39) I've never been so hungry in my life!
40) Dairy free to help with suspected allergies in bubs
41) Since having my baby I have been craving and eating way more high sugar foods than I would normally eat. I'm eating way more treat food
42) I have had to avoid bulk lots of milk consumption
43) I have started snacking more - biscuits, toast, juice, crackers and the like.
44) I limit my dairy intake as it seems to affect my baby's tummy - mostly I have cut out milk. I substitute cow's milk with soy milk, but I continue to have small amounts of cheese / yoghurt / other dairy products with no noticeable effect.
45) Baby has been formula feed from 7 weeks due to low supply
46) Only stopping due to going back to work at 5.5months. If I can make breast feeding work I will continue to do so
47) Pescatarian
48) it is really difficult to prepare meals for the family that are nutritious due to lack of time and money
49) I greatly limited my cow's milk intake during first 8 weeks because I was told it caused colic
50) Drinking more water
51) Baby has allergy to crustaceans and likely dairy so I am dairy free
52) I try to make sure I'm getting good things in to provide baby with plenty of high quality milk. I wish to at least continue to express and supplement his diet with breastmilk until he is at least 18 months so I need to nourish my body in order to do that. I've been lucky to have an incredible supply starting with colostrum prior to his birth, not all mothers are so lucky
53) I find that I am way way hungrier now than when I was pregnant. I have tried to get an answer about the extra nutritional requirements of a bf mum but get useless "just snack when you feed the baby". There must be some reliable knowledge about how much more is required.
54) Having lactation cookies for milk nutrition
55) The question about limiting seafood consumption - I have not deliberately limited consumption of seafood but I don't eat it very often. The biggest change is my diet is that I am eating way more store bought products rather than making them myself

(e.g. muesli bars, bliss balls, muesli, sauces, nut butter etc). This is mainly to save time and energy. This has led to an increase in sugar consumption.

56) My diet has gone a little back to having some sugars as gestational diabetes is gone. I also eat very limited gluten as I sometimes respond badly to products with gluten
57) I am combination breast and formula feeding
58) I've generally maintained the same diet pre, during and post pregnancy
59) My appetite (large pre-pregnancy, small during pregnancy) has gone into overdrive during breastfeeding.

Appendix B: Study poster

Are you pregnant or have a baby less than 6 months old?

We want to invite you to participate in our study!

Why this study?

A mother's diet during pregnancy and breastfeeding is important for the health of herself and her baby. To better support mothers, we want to find out about their food choices and where information comes from.

What will I need to do?

- Fill in simple online questionnaires (each 10-20 minutes) about your food choices and where you find information.

Why should I take part?

- Help provide evidence for pregnancy and breastfeeding
- Receive a copy of the study results
- You will gain access to a wider Massey University study: *Vegetables as a first food for babies*, that has great resources for complementary feeding!

If you are interested in taking part in the study or have any questions, I would love to hear from you.

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

MUHEC: Southern A, Application SOA 18/56.

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Appendix C: Study information sheet

MASSEY UNIVERSITY
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New Zealand women's dietary choices during pregnancy and lactation

Information sheet

You are invited to take part in the Woman's dietary choices during pregnancy and lactation study which is looking at the woman's food choices during pregnancy and lactation and where food and nutrition information is sourced from. This study is part of a wider study called the *Vegetables as first foods for babies'* study that is taking place in Auckland. If you would like more information about the wider study, please refer to the website https://www.vegesfirststudy.co.nz/

If you agree to take part in this study, you will be asked to sign a Consent Form.

WHAT IS THIS STUDY ABOUT?

During pregnancy and lactation (breastfeeding), mothers are recommended to make substantial changes to their diets to meet their increased nutrient requirements and to ensure food safety. Therefore, it is important that mothers receive adequate nutrition information for both their health and their developing babies. However, despite the importance of food and nutrition during this time, there is limited evidence for mothers' food choices and where information comes from, especially in New Zealand. This study aims to gather this missing evidence to develop an understanding of how well food and nutrition information is currently being communicated, understood, and followed by New Zealand mothers. This evidence may justify future interventions that may improve the health of New Zealand mothers and babies.

WHO CAN TAKE PART?

We are recruiting mothers who are in their second or third trimester of pregnancy OR have a baby less than six months of age. Mothers can be living anywhere in New Zealand as this study is completed online.

WHAT WILL MY PARTICIPATION INVOLVE?

In total you will be asked to complete five online questionnaires that take between 10-20 minutes each to complete.

The first questionnaire asks questions about you, which will provide us more detail about the woman in our study. The next four questionnaires ask questions about your food choices during pregnancy and after giving birth. These questionnaires will be sent out in two emails if you begin the study during your pregnancy or in one email if you are completing the questionnaires after giving birth.

WHAT ARE MY RIGHTS?

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

- decline to answer any particular question;

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- 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.

DATA MANAGEMENT

The data will be used only for the purposes of this project and no individual will be identified. Only the investigators and administrators of the study will have access to personal information and this will be kept secure and strictly confidential. Participants will be identified only by a study identification number.

Results of this project may be published or presented at conferences or seminars. No individual will be able to be identified. At the end of this study the list of participants and their study identification number will be disposed of.

WHAT HAPPENS IF I CHANGE MY MIND?

You are able to stop participating in the study at any time. Further you are welcome to discuss any concerns you have with the research team at any time, and you have free access to your data. If you withdraw from the study all of the data that was related to you will be destroyed.

The study data will be stored at a secure location at Massey University Albany Campus. Electronic data and records will be the responsibility of the Principal investigator. All data will be kept for 10 years, at which point it will be destroyed using University Security methods for removal of confidential material.

WHO DO I CONTACT FOR MORE INFORMATION OR IF I HAVE CONCERNS?

If you have any questions, concerns or complaints about the study at any stage, you can contact researchers in the study.

Kimberley Brown Masters candidate School of Sport, Exercise and Nutrition [redacted] K.Brown1@massey.ac.nz	**Jeanette Rapson** PhD candidate, registered dietitian School of Sport, Exercise and Nutrition [redacted] vegesfirst@massey.ac.nz
Cath Conlon Senior Lecturer School of Sport, Exercise and Nutrition 09 414 0800 ext. 43658 C.Conlon@massey.ac.nz	**Pamela Von Hurst** Associate Professor School of Sport, Exercise and Nutrition 09 414 0800 ext. 43657 P.R.vonHurst@massey.ac.nz

Committee Approval Statement

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern A, Application SOA 18/56. If you have any concerns about the conduct of this research, please contact Dr Lesley Batten, Chair, Massey University Human Ethics Committee: Southern A,telephone + 64 6 356 9099 x 85094, email humanethicsoutha@massey.ac.nz .

MUHEC: Southern A, Application SOA 18/56

Appendix D: Eligibility questionnaire

Block: Introduction (1 Question)
Block: Mother with newborn baby (4 Questions)
Standard: Registration (5 Questions)

Page Break

Start of Block: Introduction

Eligibility Screening Questionnaire

Thank you for taking the time to complete this 2-5 minute questionnaire.

Your answers will help us identify if you are eligible to participate in the study.
All information that you provide will be kept confidential.

If you have any questions, please contact:
Kimberley Brown on [redacted] | K.Brown1@massey.ac.nz

All information in this questionnaire will be kept confidential.

Committee Approval Statement
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Page Break

End of Block: Introduction

Start of Block: Mother with newborn baby

Q1 Please choose one of the following options that best describes you.

- ○ I am currently pregnant (1)
- ○ I am a mother with a baby less than 6 months of age (2)

Page Break

Display This Question:
If Q1 = 1

Q2 When is your due date? *Please choose a date.*

	Month	Day	Year
Please Select: (Newborn Q1_1)	▼ January (1 ... December (12)	▼ 1 (1 ... 31 (31)	▼ 2018 (1 ... 2020 (3)

Display This Question:
If Q1 = 2

Q3 When was your baby born? *Please choose a date.*

	Month	Day	Year
Please Select: (Newborn Q1_1)	▼ January (1 ... December (12)	▼ 1 (1 ... 31 (31)	▼ 2018 (1 ... 2020 (3)

Page Break

Q4 What is your postcode? *Please write in the text box.*

If you do not know your postcode, please click here.

Page Break

End of Block: Mother with newborn baby

Start of Block: Registration

Registration

Please provide the following details so that a researcher can contact you about the study.

First name*

_____

Last name*

_____

E-mail*

_____

Phone

_____

End of Block: Registration

Block: Default Question Block (6 Questions)

Page Break

Start of Block: Default Question Block

Participant consent form

Q1 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 for my baby and I to participate in the study under the conditions set out in the Information Sheet.

- ○ Agree (1)

Q2 Parent/Caregiver

- ○ First name (1) _____
- ○ Last name (2) _____

Q3 Baby *(optional)*

Note: If you haven't chosen a name yet, please enter baby's surname.

- First name (1) _____
- Last name (2) _____

Q4 Are you willing to be contacted regarding future research projects within the School of Sport Exercise and Nutrition? Your name and email address will be saved in a secure location. You will be sent periodic newsletters regarding research studies within the School. You can opt out of this newsletter at any time.

- Yes (1)
- No (2)

Q6 Date of consent:

	Month	Day	Year
Please Select: (Q6_1)	▼ January (1 ... December (12)	▼ 1 (1 ... 31 (31)	▼ 2018 (1 ... 2020 (3)

End of Block: Default Question Block

Survey Flow

Block: Introduction (1 Question)
Standard: Grouping questions (3 Questions)

Branch: New Branch
If
If Choose one of the following options that best describes you. I have a baby less than six months of age Is Selected

Block: Section A: Health (had baby) (7 Questions)
Block: Section B: lifestyle (had baby) (7 Questions)

Branch: New Branch
If
If Please choose one of the following options that best describes you. (please select one) I am currently pregnant Is Selected

Block: Section A: Health (pregnancy) (7 Questions)
Block: Lifestyle (pregnancy) (7 Questions)

Block: Personal information (pregnancy) (8 Questions)

Page Break

Start of Block: Introduction

Finding out about you

Thank you for taking the time to complete this questionnaire.
It should take approximately **10-15 minutes** to complete.

This questionnaire is divided into three sections; Health, Lifestyle, and Personal Information.
Please answer all questions yourself. This is **not a test**.

If you have any questions, please contact:
Kimberley Brown on [redacted] | K.Brown1@massey.ac.nz
or Dr Cath Conlon on 09 4140800 ext 43658 | C.Conlon@massey.ac.nz

All information in this questionnaire will be kept confidential.

Committee Approval Statement
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Page Break

End of Block: Introduction

Start of Block: Grouping questions

ID Please enter your participant number:

_____

Note: this number was sent to you in the email with the questionnaire links. It will be used to match up data sets, not to personally identify you.

Q1 Choose one of the following options that best describes you.

- ○ I am currently pregnant (1)
- ○ I have a baby less than six months of age (2)

Page Break

End of Block: Grouping questions

Start of Block: Section A: Health (had baby)

Page Break

Section A: Health

The following questions will ask about your health before and during your pregnancy.

QA1 During your pregnancy, were you diagnosed with the following?

	Yes (1)	No (2)	Choose not to answer (3)

Anaemia (1)	○	○	○
Iron deficiency (2)	○	○	○
High blood pressure (3)	○	○	○
Gestational diabetes (5)	○	○	○
Heartburn (6)	○	○	○
Other deficiencies or conditions (please specify) (7)	○	○	○

Page Break

QA2 Before your pregnancy, in general, how would you describe your health?

- ○ Poor (1)
- ○ Fair (2)
- ○ Good (3)
- ○ Very Good (4)
- ○ Excellent (5)
- ○ Choose not to answer (6)
- ○ Other (please specify) (7) _____

QA2.1 Did this description change during your pregnancy?

- ○ Yes (1)
- ○ No (2)
- ○ Choose not to answer (3)

Skip To: QA3 If QA2.1 = 2
Skip To: QA3 If QA2.1 = 3

QA2.2 How did your health change?

- ○ Worse (1)
- ○ Better (2)
- ○ Choose not to answer (3)
- ○ Other (please specify) (4)

_____

Page Break

QA3 Is this your first baby?

- ○ Yes (1)
- ○ No (2)
- ○ Choose not to answer (3)

Skip To: End of Block If QA3 = 1
Skip To: End of Block If QA3 = 3

QA3.1 How many other children do you have?

- ○ One (1)
- ○ Two (2)
- ○ Three (3)
- ○ Four (4)
- ○ Five (5)
- ○ More than five (please specify) (6)

_____

- ○ Choose not to answer (7)

Page Break

End of Block: Section A: Health (had baby)

Start of Block: Section B: lifestyle (had baby)

QB **Section B: Lifestyle**
The following questions will ask about your lifestyle choices before and during your pregnancy.

QB1 Over the 6 months prior to becoming pregnant were you actively dieting or trying to lose weight?

- Yes (1)
- No (2)
- Choose not to answer (3)

Skip To: QB2 If QB1 = 2
Skip To: QB2 If QB1 = 3

QB1.1 Did you lose any weight?

- Yes (1)
- No (2)
- Unsure (3)
- Choose not to answer (4)

Skip To: End of Block If QB1.1 = 3
Skip To: End of Block If QB1.1 = 2
Skip To: End of Block If QB1.1 = 4

QB1.2 Approximately how much weight did you lose? *Please write in the text box.*

_____

Skip To: End of Block If QB1.2 Is Empty

Skip To: End of Block If QB1.2 Is Not Empty

Page Break

QB2 Over the 6 months prior to becoming pregnant, were you actively trying to gain weight?

- ○ Yes (1)
- ○ No (2)
- ○ Choose not to answer (3)

Skip To: End of Block If QB2 = 2
Skip To: End of Block If QB2 = 3

QB2.1 Did you gain any weight?

- ○ Yes (1)
- ○ No (2)
- ○ Unsure (3)
- ○ Choose not to answer (4)

Skip To: End of Block If QB2.1 = 2
Skip To: End of Block If QB2.1 = 3
Skip To: End of Block If QB2.1 = 4

QB2.2 Approximately how much weight did you gain? *Please write in the text box.*

_____

Page Break

End of Block: Section B: lifestyle (had baby)

Start of Block: Section A: Health (pregnancy)

Section A: Health

The following questions will ask about your current and past health.

QA1 Have you been diagnosed with the following during your pregnancy?

	Yes (1)	No (2)	Choose not to answer (3)
Anaemia (1)	○	○	○
Iron deficiency (2)	○	○	○
High blood pressure (3)	○	○	○
Gestational diabetes (5)	○	○	○
Heartburn (6)	○	○	○
Other deficiencies or conditions (please specify) (7)	○	○	○

Page Break

QA2 Before your pregnancy, in general, how would you describe your health?

- ○ Poor (1)
- ○ Fair (2)
- ○ Good (3)
- ○ Very Good (4)
- ○ Excellent (5)
- ○ Choose not to answer (6)
- ○ Other (please specify in text box below) (7)

_____

QA2.1 Has this description changed since becoming pregnant?

- ○ Yes (1)
- ○ No (2)
- ○ Choose not to answer (3)

Skip To: QA3 If QA2.1 = 2
Skip To: QA3 If QA2.1 = 3

QA2.2 How has your health changed?

- ○ Worse (1)
- ○ Better (2)
- ○ Choose not to answer (3)
- ○ Other (please specify) (4) _____

Page Break

QA3 Is this your first baby?

- ○ Yes (1)
- ○ No (2)
- ○ Choose not to answer (3)

Skip To: End of Block If QA3 = 1
Skip To: End of Block If QA3 = 3

Page Break

QA3.1 How many other children do you have?

- ○ One (1)
- ○ Two (2)
- ○ Three (3)
- ○ Four (4)
- ○ Five (5)
- ○ More than five (please specify) (6) _____
- ○ Choose not to answer (7)

Page Break

End of Block: Section A: Health (pregnancy)

Start of Block: Lifestyle (pregnancy)

QB **Section B: Lifestyle**
The following questions will ask about your lifestyle choices.

QB1 Over the 6 months prior to becoming pregnant, were you actively dieting or trying to lose weight?

- ○ Yes (1)
- ○ No (2)
- ○ Choose not to answer (3)

Skip To: QB2 If QB1 = 2
Skip To: QB2 If QB1 = 3

Q1.1 Did you lose any weight?

- ○ Yes (1)
- ○ No (2)
- ○ Unsure (3)
- ○ Choose not to answer (4)

Skip To: End of Block If Q1.1 = 2
Skip To: End of Block If Q1.1 = 4
Skip To: End of Block If Q1.1 = 3

QB1.2 Approximately how much weight did you lose? *Please write in the text box.*

_____

Skip To: End of Block If QB1.2 Is Not Empty
Skip To: End of Block If QB1.2 Is Empty

Page Break

QB2 Over the 6 months prior to becoming pregnant, were you actively trying to gain weight?

- ○ Yes (1)
- ○ No (2)
- ○ Choose not to answer (3)

Skip To: End of Block If QB2 = 2
Skip To: End of Block If QB2 = 3

QB2.1 Did you gain any weight?

- ○ Yes (1)
- ○ No (2)
- ○ Unsure (3)
- ○ Choose not to answer (4)

Skip To: End of Block If QB2.1 = 2
Skip To: End of Block If QB2.1 = 4
Skip To: End of Block If QB2.1 = 3

Page Break

Q2.2 Approximately how much weight did you gain? *Please write in the text box.*

_____

Page Break

End of Block: Lifestyle (pregnancy)

Start of Block: Personal information (pregnancy)

Section C: Personal Information
We would like to learn more about you.

JS

QC1 What is your date of birth?

	Month	Day	Year
Please Select: (1)	▼ January (1 ... December (12)	▼ 1 (1 ... 31 (31)	▼ 1900 (1 ... 2049 (150)

Page Break

QC2 What is the gender of your baby?

- ○ Male (1)
- ○ Female (2)
- ○ Other (3)
- ○ Not sure yet (4)
- ○ Choose not to answer (5)

Page Break

QC3 Which ethnic group(s) do you belong to? *Please select all that apply.*

- [ ] New Zealand European/ Pakeha (1)
- [ ] New Zealand Māori (2)
- [ ] Cook Island Māori (3)
- [ ] Fijian (4)
- [ ] Samoan (5)
- [ ] Tongan (6)
- [ ] Other Pacific Island (7)
- [ ] Other European (8)
- [ ] Chinese (9)
- [ ] South East Asian (10)
- [ ] Other Asian (11)
- [ ] ⊗ Choose not to answer (12)
- [ ] Other (please specify) (13) _____

Page Break

QC4 What is your highest qualification? *Please select one.*

- ○ School certificate/ NCEA level 1 (1)
- ○ 6th form certificate/ NCEA 2 (2)
- ○ NCEA level 3 (3)
- ○ Graduate degree/diploma (4)
- ○ Masters (5)
- ○ PhD (6)
- ○ None of the above (7)
- ○ None, yet (still in school) (8)
- ○ Choose not to answer (9)
- ○ Other (please specify) (10) _____

Page Break

QC5 What is your postcode? *Please write in the text box.*

If you do not know your postcode, click here.

Please note: your postcode is for the area you live in, not your house. This is so we cannot identify who you are from your postcode

_____

Page Break

QC6 How would you describe your household's food availability? *Please select one.*

- ○ Limited (1)
- ○ At times limited (2)
- ○ Adequate (3)
- ○ Choose not to answer (4)
- ○ Other (please specify) (5)

_____

Page Break

QC7 Is there anything else that you would like to tell us about yourself? *Please comment in the text box below.*

_____

End of Block: Personal information (pregnancy)

Appendix G: Pregnancy food frequency questionnaire

Block: Default Question Block (1 Question)
Standard: Pregnancy/newborn? (1 Question)
Block: Pregnancy (30 Questions)

Page Break

Pregnancy Food Frequency Questionnaire

Thank you for taking the time to complete this questionnaire.
It should take approximately **20 minutes** to complete.

This is **not a test**. Your answers will help us learn about food choices during pregnancy.

If you have any questions, please contact:
Kimberley Brown on [redacted] | K.Brown1@massey.ac.nz
or Dr Cath Conlon on 09 4140800 ext 43658 | C.Conlon@massey.ac.nz

All information in this questionnaire will be kept confidential.

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End of Block: Default Question Block

Start of Block: Pregnancy/newborn?

QA Choose one of the following that best describes you.

- ○ I am pregnant (1)
- ○ I have a baby less than six months old (2)

End of Block: Pregnancy/newborn?

Start of Block: Pregnancy

ID Please enter your participant number:

_____

Note: this number was sent to you in the email with the questionnaire links. It will be used to match up data sets, not to personally identify you.

Page Break

Intro

Vegetables and fruit

We would like to ask you about the types of vegetables and fruit you choose to eat during your pregnancy.

Note

You may have eaten some foods more frequently depending on the season. For example, you may have eaten cherries most days during summer months, but never at other times during your pregnancy. In this case, please indicate "most days".

1 How often have you eaten these **vegetables** during pregnancy?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once during my pregnancy (1)
 Artichokes	○	○	○	○	○
 Asparagus	○	○	○	○	○
 Beetroot	○	○	○	○	○

Page Break

2 How often have you eaten these **vegetables** during pregnancy?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once during my pregnancy (1)
 Broccoli	○	○	○	○	○
 Brussel sprouts	○	○	○	○	○
 Cabbage (all varieties)	○	○	○	○	○

Page Break

3 How often have you eaten these **vegetables** during pregnancy?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once during my pregnancy (1)
 Capsicum, peppers (all varieties)	○	○	○	○	○
 Carrots	○	○	○	○	○
 Cauliflower	○	○	○	○	○

Page Break

4 How often have you eaten these **vegetables** during pregnancy?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once during my pregnancy (1)
 Corn (all varieties)	○	○	○	○	○
 Courgette, zucchini, marrow (all varieties)	○	○	○	○	○
 Green beans, broad beans (all varieties)	○	○	○	○	○

Page Break

5 How often have you eaten these **vegetables** during pregnancy?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once during my pregnancy (1)
 Kale	○	○	○	○	○
 Kumara	○	○	○	○	○
 Lettuce	○	○	○	○	○
 Cucumber	○	○	○	○	○

Page Break

6 How often have you eaten these **vegetables** during pregnancy?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once during my pregnancy (1)
 Mushrooms	○	○	○	○	○
 Onions (all varieties), leeks	○	○	○	○	○
 Celery	○	○	○	○	○
 Other green leafy vegetables (e.g. watercress, puha, salad greens)	○	○	○	○	○

Page Break

7 How often have you eaten these **vegetables** during pregnancy?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once during my pregnancy (1)
 Peas, green	○	○	○	○	○
 Potato	○	○	○	○	○
 Pumpkin, squash	○	○	○	○	○
 Yams	○	○	○	○	○

8 How often have you eaten these **vegetables** during pregnancy?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once during my pregnancy (1)
 Radishes (all varieties)	○	○	○	○	○
 Spinach, silver beet	○	○	○	○	○
 Sprouted beans and seeds	○	○	○	○	○
 Tomatoes (all varieties)	○	○	○	○	○

Page Break

9 **Fruit**



How often have you eaten these types of **fruit** during pregnancy?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once during my pregnancy (1)
Apples	○	○	○	○	○
Bananas, green bananas	○	○	○	○	○
Kiwi fruit	○	○	○	○	○
Cherries	○	○	○	○	○
Grapefruit	○	○	○	○	○
Lemons	○	○	○	○	○
Oranges, mandarins	○	○	○	○	○

Page Break

10 **Fruit**

How often have you eaten these types of **fruit** during pregnancy?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once during my pregnancy (1)
Feijoas	○	○	○	○	○
Grapes	○	○	○	○	○
Mango	○	○	○	○	○
Melon (e.g. honey dew, rock melon)	○	○	○	○	○
Pears	○	○	○	○	○
Pineapple	○	○	○	○	○
Nashi pears, Chinese pears	○	○	○	○	○
Watermelon	○	○	○	○	○

Page Break




11 **Fruit**

How often have you eaten these types of **fruit** during pregnancy?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once during my pregnancy (1)
Apricots	○	○	○	○	○
Nectarines	○	○	○	○	○
Pawpaw (papaya)	○	○	○	○	○
Peaches	○	○	○	○	○
Persimmon	○	○	○	○	○
Plums	○	○	○	○	○
Lychees	○	○	○	○	○

Page Break




12 **Fruit**

How often have you eaten these types of fruit during pregnancy?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once during my pregnancy (1)
Avocadoes	○	○	○	○	○
Olives	○	○	○	○	○
Rhubarb	○	○	○	○	○
Tamarillos	○	○	○	○	○
Fruit salad, canned	○	○	○	○	○
Berries (e.g. strawberries, blackberries, blueberries, raspberries)	○	○	○	○	○
Sultanas, raisins, currants, figs	○	○	○	○	○
Dried apricots, prunes, dates, mixed dried fruit	○	○	○	○	○

Page Break

13 **Lean meats, poultry**

How often have you eaten **lean meats and poultry** during pregnancy?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once during my pregnancy (1)
Red meat (e.g. beef, lamb or pork)	○	○	○	○	○
Poultry (e.g. chicken, turkey or duck)	○	○	○	○	○

Page Break

14 **Fish**

How often have you eaten **fish** during pregnancy?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once during my pregnancy (1)
Oily fish (e.g. salmon, tuna, mackerel, sardines)	○	○	○	○	○
White fish (e.g. cod, bass, snapper, lemon fish)	○	○	○	○	○

Page Break

15 **Seafood and shellfish**

How often have you eaten **seafood and shellfish** during pregnancy?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once during my pregnancy (1)
Crustaceans (e.g. shrimp, crab, prawns, lobster)	○	○	○	○	○
Mollusks (e.g. clams, oysters, mussels, scallops, octopus, squid)	○	○	○	○	○

Page Break




16 **Legumes, nuts and seeds**

How often have you eaten **legumes, nuts and seeds** during pregnancy?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once during my pregnancy (1)
Legumes (e.g. chickpeas, lentils, butter beans)	○	○	○	○	○
Nuts or nut butters (e.g. almonds, brazil nuts, cashews, peanuts)	○	○	○	○	○
Seeds (e.g. pumpkin seeds, sunflower seeds)	○	○	○	○	○
Tofu	○	○	○	○	○

Page Break

17 **Grains**

How often have you eaten **grains** during pregnancy?

Note: *please assume all foods below include options for special diets, e.g. gluten-free.*

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once during my pregnancy (1)
Breads	○	○	○	○	○
Breakfast cereals	○	○	○	○	○
Rice, pasta or noodles	○	○	○	○	○
Other grains (e.g. couscous, quinoa, polenta)	○	○	○	○	○
Wholegrain versions of the above foods	○	○	○	○	○

Page Break

18 **Milk and milk alternatives**

How often have you consumed milk and milk alternatives during pregnancy?

Note: *please assume all items listed below have been prepared safely for pregnancy.*

	Never (0)	Most days (4)	At least once per week (3)	At least once a month (2)	At least once during my pregnancy (1)
Low fat cow’s milk	○	○	○	○	○
Full fat cow's milk	○	○	○	○	○
Non-fortified milk alternatives (e.g. almond, rice, soy)	○	○	○	○	○
Calcium-fortified milk alternatives (e.g. almond, rice, soy)	○	○	○	○	○

Page Break

19 **Yoghurt and dairy foods**

How often have you eaten yoghurt and dairy foods during pregnancy?

Note: *please assume all items listed below have been prepared safely for pregnancy.*

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once during my pregnancy (1)
Yoghurt (plain, unsweetened)	○	○	○	○	○
Yoghurt (flavoured varieties)	○	○	○	○	○
Ice cream (all varieties)	○	○	○	○	○

Page Break

20 **Cheese**

How often have you eaten cheese during pregnancy?

Note: *please assume all cheese listed below have been prepared safely for pregnancy.*

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once during my pregnancy (1)
Strong flavoured cheese (e.g. blue, aged, feta, halloumi, swiss, parmesan, tasty)	○	○	○	○	○
Mild flavoured cheese (e.g. brie, camembert, mozzarella, ricotta, cottage, gouda)	○	○	○	○	○
Cream cheese, cheese spreads	○	○	○	○	○

Page Break

21 **Sea vegetables**

How often have you eaten **seaweed** during pregnancy?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once during my pregnancy (1)
Brown seaweed (kelp, kombu, wakame, arame, quandai-cai, hiziki, sargassum, fusiforme, nori, karengo)	○	○	○	○	○
Green or red seaweed (nori, karengo)	○	○	○	○	○

Page Break

22 **Herbs, spices and dressings**

How often have consumed these **herbs, spices and dressings** during pregnancy?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once during my pregnancy (1)
Garlic	○	○	○	○	○
Ginger	○	○	○	○	○
Onion	○	○	○	○	○
Chilli (all varieties)	○	○	○	○	○
Curry (powder or paste)	○	○	○	○	○
Wasabi	○	○	○	○	○
Lemon or lime	○	○	○	○	○
Herbs (e.g. parsley, chives, oregano)	○	○	○	○	○
Salad dressing	○	○	○	○	○
Other, please specify:	○	○	○	○	○

Page Break



23 **Seasonings**

How often have you added these **seasonings** to your foods or drinks during pregnancy?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once during my pregnancy (1)
Sugar (all varieties, including honey)	○	○	○	○	○
Salt (non-iodised)	○	○	○	○	○
Salt (iodised)	○	○	○	○	○
Pepper	○	○	○	○	○
Other, please specify:	○	○	○	○	○

Page Break

24 **Cakes and biscuits**

How often have you eaten these foods during pregnancy?

Note: please assume all foods listed below have been prepared safely for pregnancy.

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once during my pregnancy (1)
Cakes, slices, muffins (all sweet varieties)	○	○	○	○	○
Biscuits (all sweet varieties)	○	○	○	○	○

Page Break




25 **Drinks**

How often have you chosen to drink these items during pregnancy?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once during my pregnancy (1)
Water	○	○	○	○	○
Fruit juice (all varieties)	○	○	○	○	○
Complan, Sustagen (all varieties)	○	○	○	○	○
Hot chocolate, drinking chocolate, cocoa, Ovaltine, Nesquik, milo	○	○	○	○	○
Tea (all varieties)	○	○	○	○	○
Coffee (all varieties)	○	○	○	○	○

Page Break

25 Please choose the response that best describes you.

	Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree (5)	Disagree (6)	Strongly disagree (7)
I have a 'sweet tooth', that is, I have a preference for sweet foods	○	○	○	○	○	○	○
I have a 'savoury palate', that is, I have a preference for salty, spicy or less sweet foods	○	○	○	○	○	○	○

Page Break

26 Is there anything else that you would like to tell us about your food and drink choices during pregnancy?

_____

End of Block: Pregnancy

Block: Default Question Block (1 Question)
Standard: Grouping question (3 Questions)
Block: Food choices (23 Questions)

Page Break

Start of Block: Default Question Block

Pregnancy Food Choices Questionnaire

Thank you for taking the time to complete this questionnaire.
It should take approximately **15 minutes** to complete.

This is **not a test**. Your answers will help us learn about food choices during pregnancy.

If you have any questions, please contact:
Kimberley Brown on [redacted] | K.Brown1@massey.ac.nz
or Dr Cath Conlon on 09 4140800 ext 43658 | C.Conlon@massey.ac.nz

All information in this questionnaire will be kept confidential.

Committee Approval Statement
This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern A, Application SOA 18/56. If you have any concerns about the conduct of this research, please contact Dr Lesley Batten, Chair, Massey University Human Ethics Committee: Southern A, telephone + 64 6 356 9099 x 85094, email humanethicsoutha@massey.ac.nz.

End of Block: Default Question Block

Start of Block: Grouping question

Q1 Please enter your participant number:

_____

Note: this number was sent to you in the email with the questionnaire links. It will be used to match up data sets, not to personally identify you.

Page Break

Choose one of the following that best describes you.

- ○ I am pregnant (1)
- ○ I have a baby less than six months old (2)

End of Block: Grouping question

Start of Block: Food choices

Food choice intro
Food Choices
The following questions ask about your food and drink choices during pregnancy.

1a Which of the following foods and/or drinks have you avoided during your pregnancy? Please select all that apply.

Note: *please assume all foods listed have been served cold or warm, that is, below 70 ºC.*

- ☐ Processed meats (e.g. pâté, salami, ham and luncheon) (1)
- ☐ Cold pre-cooked meat such as chicken (plain or smoked) and corned beef (2)
- ☐ Raw (unpasteurised) milk and raw milk products (3)
- ☐ Soft pasteurised cheese (e.g. brie, camembert, feta, blue, mozzarella and ricotta) (4)
- ☐ Ready-made salads (5)
- ☐ Hummus (6)
- ☐ Tahini (7)
- ☐ ⊗ I have not avoided any food and/or drinks (8)
- ☐ ⊗ Choose not to answer (9)

Page Break

1b Which of the following foods and/or drinks have you avoided during your pregnancy? *Please select all that apply.*

Note: *please assume all foods listed have been served cold or warm, that is, below 70 ºC.*

- ☐ Raw, smoked or pre-cooked fish or seafood (including sushi, smoked salmon, marinated mussels or oysters) (1)
- ☐ Foods containing raw egg (e.g. smoothies, mayonnaise, hollandaise sauce or desserts such as mousse) (2)
- ☐ Soft-serve ice cream (3)
- ☐ Cream or custard (including pre-made cakes or pastries) (4)
- ☐ Alcohol (5)
- ☐ ⊗ I have not avoided any food and/or drinks (6)
- ☐ ⊗ Choose not to answer (7)
- ☐ Other, please specify: (8) _____

Skip To: 2a If 1b = 6

Page Break

1c For what reason/s have you **avoided** these foods during your pregnancy? *Please select all that apply.*

- [ ] I was told by a health professional (1)
- [ ] I was told by a family member or friend (2)
- [ ] My religion/beliefs (3)
- [ ] Following New Zealand pregnancy guidelines (4)
- [ ] Following internet, book, newspaper, or magazine advice (5)
- [ ] Food safety concerns (6)
- [ ] These foods or drinks cause nausea/vomiting (7)
- [ ] I have an allergy or food intolerance (8)
- [ ] I dislike these foods or drinks (9)
- [ ] ⊗ Not sure (10)
- [ ] ⊗ Choose not to answer (11)
- [ ] Other, please specify: (12) _____

Page Break

2a Which of the following foods/drinks have you **increased consumption** of during your pregnancy? *Please select all that apply.*

Note: please assume all foods listed below have been prepared safely for pregnancy.

- [ ] Dairy products (1)
- [ ] Sardines (2)
- [ ] Salmon (3)
- [ ] Leafy green vegetables (4)
- [ ] Fortified cereals (added nutrients, e.g. iron) (5)
- [ ] Meat (6)
- [ ] Nuts (7)
- [ ] Tofu (8)
- [ ] ⊗ I have not added any new foods to my diet (9)
- [ ] ⊗ Choose not to answer (10)
- [ ] Other, please specify: (11) _____

Skip To: 4a If 2a = 9

Page Break

2b For what reason/s have you **increased consumption** of these foods/drinks during pregnancy? *Please select all that apply.*

- ☐ I was told by a health professional (1)
- ☐ I was told by a family member or friend (2)
- ☐ Following the New Zealand pregnancy guidelines (3)
- ☐ Following internet, book, newspaper, or magazine advice (4)
- ☐ Food cravings (5)
- ☐ For my baby's health (6)
- ☐ To get more iron and/or calcium in my diet (7)
- ☐ ⊗ Choose not to answer (8)
- ☐ Other, please specify: (9) _____

Page Break

X→

3a Which of the following foods have you **limited** (e.g. no more than once per week) during your pregnancy? *Please select all that apply.*

Note: *please assume all foods listed below have been prepared safely for pregnancy.*

- [ ] Cooked Bluff or Pacific oysters, or queen scallops (1)
- [ ] Canned fish (like tuna, salmon or sardines), tarakihi, blue cod, hoki, john dory, monkfish, warehou, flounder and whitebait (2)
- [ ] Longer-lived and larger fish (e.g. farmed salmon, snapper, uncanned albacore tuna and mackerel, as well as kahawai, red cod, orange roughy and ling) (3)
- [ ] Deep-sea or lake fish (e.g. school shark, southern bluefin tuna, marlin, and trout (4)
- [ ] Brown seaweed (kelp, kombu, wakame, arame, quandai-cai, hiziki, sargassum, fusiforme) (5)
- [ ] Green or red seaweed (nori, karengo) (6)
- [ ] ⊗I have not limited any of the above foods (7)
- [ ] ⊗Choose not to answer (8)

Skip To: 4a If 3a = 7

Page Break

3b For what reason/s have you **limited** these foods during pregnancy?

- [ ] Mercury content in fish (1)
- [ ] Cadmium content in oysters and scallops (6)
- [ ] Iodine content in seaweed (3)
- [ ] I don't eat these foods (10)
- [ ] ⊗ Choose not to answer (9)
- [ ] Other, please specify: (8) _____

Page Break

4a Which of the following vitamins and/or mineral supplements have you taken **leading up to and/or during** your pregnancy? *Please select all that apply.*

Note: *supplements listed below include multivitamins containing folate or iodine, e.g. Elevit.*

- ☐ Folic acid (1)
- ☐ Iodine (2)
- ☐ ⊗ None of the above (3)
- ☐ ⊗ Choose not to answer (4)

Page Break

Display This Question:

If 4a = 1

4b For what reason/s did you take **folic acid** supplements? *Please select all that apply.*

- ☐ I was told by a health professional (1)
- ☐ I was told by a family member or friend (2)
- ☐ Following the New Zealand pregnancy guidelines (3)
- ☐ Following internet, book, newspaper, or magazine advice (4)
- ☐ ⊗ Not sure (5)
- ☐ ⊗ Choose not to answer (6)
- ☐ Other, please specify: (7) _____

Display This Question:

If 4a = 2

4c For what reason/s did you take **iodine** supplements? *Please select all that apply.*

- ☐ I was told by a health professional (1)
- ☐ I was told by a family member (2)
- ☐ I was told by a friend (3)
- ☐ Following the New Zealand pregnancy guidelines (4)
- ☐ Following internet, book, newspaper, or magazine advice (5)
- ☐ Blood tests confirmed a deficiency (6)
- ☐ ⊗ Not sure (7)
- ☐ ⊗ Choose not to answer (8)
- ☐ Other, please specify: (9) _____

Page Break

5a Have you taken other vitamin and/or mineral supplements **leading up to and/or during** your pregnancy?

- ○ Yes, please specify: (1) _____
- ○ No (2)
- ○ Choose not to answer (3)

Skip To: 6a If 5a = 2
Skip To: 6a If 5a = 3

5b For what reason/s did you take these other vitamins and/or mineral supplements? *Please select all that apply.*

- ☐ I was told by a health professional (1)
- ☐ I was told by a family member (2)
- ☐ I was told by a friend (3)
- ☐ Following the New Zealand pregnancy guidelines (4)
- ☐ Following internet, book, newspaper, or magazine advice (5)
- ☐ Blood tests confirmed a deficiency (6)
- ☐ ⊗ Not sure (7)
- ☐ ⊗ Choose not to answer (8)
- ☐ Other, please specify: (9) _____

Page Break

6a Whose advice has had the **greatest** influence on the foods and/or drinks you choose during your pregnancy? *Please select one.*

- ○ Family (1)
- ○ Friends (2)
- ○ GP/ family doctor (3)
- ○ Midwife (4)
- ○ Obstetrician (5)
- ○ Alternative health practitioner (6)
- ○ Antenatal class (7)
- ○ Internet (8)
- ○ Radio (9)
- ○ Television (TV) (10)
- ○ Books, magazines, and/or newspaper (11)
- ○ New Zealand pregnancy guidelines (12)
- ○ ⊗ Not sure (13)
- ○ ⊗ Choose not to answer (14)
- ○ Other, please specify: (15) _____

Skip To: 7 If 6a = 14
Skip To: 7 If 6a = 13

Page Break

6b What advice have you received from this place or person regarding your pregnancy?
Please select all that apply.

- ☐ Foods to **consume** (1)
- ☐ Drinks to **consume** (2)
- ☐ Foods to **avoid or limit** (3)
- ☐ Drinks to **avoid or limit** (4)
- ☐ How much food to consume (5)
- ☐ Supplements to take (6)
- ☐ Weight gain during pregnancy (7)
- ☐ Why the diet during pregnancy is important (8)
- ☐ ⊗ Choose not to answer (9)
- ☐ Other, please specify: (10) _____

Page Break

7 Which of the following handouts have you **used**? *Please select all that apply.*

- [ ] 1. Eating for healthy pregnant woman (1)
- [ ] 2. Healthy mums: your guide to eating well during pregnancy and breastfeeding (2)
- [ ] 3. Food safety: avoiding listeria (3)
- [ ] 4. Alcohol and pregnancy: what you might not know (4)
- [ ] 5. Drinking and your baby (5)
- [ ] 6. Food safety in pregnancy (6)
- [ ] ⊗ I have not used any of these handouts (7)
- [ ] ⊗ Choose not to answer (8)

Page Break

8a Who have you chosen as your lead maternal carer (LMC)?

- ○ Midwife (1)
- ○ Doctor (GP: General practitioner) (2)
- ○ Obstetrician (3)
- ○ Choose not to answer (4)
- ○ Other, please specify: (5) _____

Page Break

8b Have you received any advice about food and nutrition from your lead maternal carer (LMC)?

- ○ Yes (1)
- ○ No (2)
- ○ Choose not to answer (3)

Skip To: 9a If 8b = 2
Skip To: 9a If 8b = 3

Page Break

8c What advice have you received from your lead maternal carer (LMC) regarding your pregnancy? *Please select all that apply.*

- ☐ Foods to **consume** (1)
- ☐ Drinks to **consume** (2)
- ☐ Foods to **avoid or limit** (3)
- ☐ Drinks to **avoid or limit** (4)
- ☐ How much food to consume (5)
- ☐ Supplements to take (6)
- ☐ Weight gain during pregnancy (7)
- ☐ Why the diet during pregnancy is important (8)
- ☐ ⊗ Choose not to answer (9)
- ☐ Other, please specify: (10) _____

Page Break

9a Have you attended any antenatal classes during this pregnancy?

- Yes (1)
- No (2)
- Choose not to answer (3)

Skip To: 10 If 9a = 2
Skip To: 10 If 9a = 3

Page Break

9b Did you receive any advice about food and nutrition during these classes?

- Yes (1)
- No (2)
- Choose not to answer (3)

Skip To: 10 If 9b = 2
Skip To: 10 If 9b = 3

Page Break

9c During these classes, what advice did you receive regarding your pregnancy? *Please select all that apply.*

- ☐ Foods to **consume** (1)
- ☐ Drinks to **consume** (2)
- ☐ Foods to **avoid or limit** (3)
- ☐ Drinks to **avoid or limit** (4)
- ☐ How much food to consume (5)
- ☐ Supplements to take (6)
- ☐ Weight gain during pregnancy (7)
- ☐ Why the diet during pregnancy is important (8)
- ☐ ⊗ Choose not to answer (9)
- ☐ Other, please specify: (10) _____

Page Break

10 Is there anything else that you would like to tell us regarding your pregnancy?

_____

End of Block: Food choices

Appendix I: Lactation food frequency questionnaire

Block: Default Question Block (1 Question)
Block: ID (30 Questions)

Page Break

Start of Block: Default Question Block

Breastfeeding Food Frequency Questionnaire

Thank you for taking the time to complete this questionnaire.
It should take approximately **20 minutes** to complete.

This is **not a test**. Your answers will help us learn about food choices during breastfeeding.

If you have any questions, please contact:
Kimberley Brown on [redacted] | K.Brown1@massey.ac.nz
or Dr Cath Conlon on 09 4140800 ext 43658 | C.Conlon@massey.ac.nz

All information in this questionnaire will be kept confidential.

Committee Approval Statement
This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern A, Application SOA 18/56. If you have any concerns about the conduct of this research, please contact Dr Lesley Batten, Chair, Massey University Human Ethics Committee: Southern A, telephone + 64 6 356 9099 x 85094, email humanethicsoutha@massey.ac.nz.

End of Block: Default Question Block

Start of Block: ID

ID Please enter your participant number:

_____

Note: this number was sent to you in the email with the questionnaire links. It will be used to match up data sets, not to personally identify you.

Page Break

Intro

Vegetables and fruit

We would like to ask you about the types of vegetables and fruit you choose to eat since giving birth.

Note

You may have eaten some foods more frequently depending on the season. For example, you may have eaten cherries most days during summer months, but never at other times since giving birth. In this case, please indicate "most days".

1 How often have you eaten these **vegetables** since giving birth?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once since giving birth (1)
 Artichokes	○	○	○	○	○
 Asparagus	○	○	○	○	○
 Beetroot	○	○	○	○	○

Page Break

2 How often have you eaten these **vegetables** since giving birth?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once since giving birth (1)
 Broccoli	○	○	○	○	○
 Brussel sprouts	○	○	○	○	○
 Cabbage (all varieties)	○	○	○	○	○

Page Break

3 How often have you eaten these **vegetables** since giving birth?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once since giving birth (1)
 Capsicum, peppers (all varieties)	○	○	○	○	○
 Carrots	○	○	○	○	○
 Cauliflower	○	○	○	○	○

Page Break

4 How often have you eaten these **vegetables** since giving birth?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once since giving birth (1)
 Corn (all varieties)	○	○	○	○	○
 Courgette, zucchini, marrow (all varieties)	○	○	○	○	○
 Green beans, broad beans (all varieties)	○	○	○	○	○

Page Break

5 How often have you eaten these **vegetables** since giving birth?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once since giving birth (1)
 Kale	○	○	○	○	○
 Kumara	○	○	○	○	○
 Lettuce	○	○	○	○	○
 Cucumber	○	○	○	○	○

Page Break

6 How often have you eaten these **vegetables** since giving birth?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once since giving birth (1)
 Mushrooms	○	○	○	○	○
 Onions (all varieties), leeks	○	○	○	○	○
 Celery	○	○	○	○	○
 Other green leafy vegetables (e.g. watercress, puha, salad greens)	○	○	○	○	○

Page Break

7 How often have you eaten these **vegetables** since giving birth?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once since giving birth (1)
 Peas, green	○	○	○	○	○
 Potato	○	○	○	○	○
 Pumpkin, squash	○	○	○	○	○
 Yams	○	○	○	○	○

8 How often have you eaten these **vegetables** since giving birth?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once since giving birth (1)
 Radishes (all varieties)	○	○	○	○	○
 Spinach, silver beet	○	○	○	○	○
 Sprouted beans and seeds	○	○	○	○	○
 Tomatoes (all varieties)	○	○	○	○	○

Page Break

9 **Fruit**



How often have you eaten these types of **fruit** since giving birth?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once since giving birth (1)
Apples	○	○	○	○	○
Bananas, green bananas	○	○	○	○	○
Kiwi fruit	○	○	○	○	○
Cherries	○	○	○	○	○
Grapefruit	○	○	○	○	○
Lemons	○	○	○	○	○
Oranges, mandarins	○	○	○	○	○

Page Break

10 **Fruit**

How often have you eaten these types of **fruit** since giving birth?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once since giving birth (1)
Feijoas	○	○	○	○	○
Grapes	○	○	○	○	○
Mango	○	○	○	○	○
Melon (e.g. honey dew, rock melon)	○	○	○	○	○
Pears	○	○	○	○	○
Pineapple	○	○	○	○	○
Nashi pears, Chinese pears	○	○	○	○	○
Watermelon	○	○	○	○	○

Page Break




11 **Fruit**

How often have you eaten these types of **fruit** since giving birth?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once since giving birth (1)
Apricots	○	○	○	○	○
Nectarines	○	○	○	○	○
Pawpaw (papaya)	○	○	○	○	○
Peaches	○	○	○	○	○
Persimmon	○	○	○	○	○
Plums	○	○	○	○	○
Lychees	○	○	○	○	○

Page Break




12 **Fruit**

How often have you eaten these types of fruit since giving birth?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once since giving birth (1)
Avocadoes	○	○	○	○	○
Olives	○	○	○	○	○
Rhubarb	○	○	○	○	○
Tamarillos	○	○	○	○	○
Fruit salad, canned	○	○	○	○	○
Berries (e.g. strawberries, blackberries, blueberries, raspberries)	○	○	○	○	○
Sultanas, raisins, currants, figs	○	○	○	○	○
Dried apricots, prunes, dates, mixed dried fruit	○	○	○	○	○

Page Break

13 **Lean meats, poultry**

How often have you eaten **lean meats and poultry** since giving birth?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once since giving birth (1)
Red meat (e.g. beef, lamb or pork)	○	○	○	○	○
Poultry (e.g. chicken, turkey or duck)	○	○	○	○	○

Page Break

14 **Fish**

How often have you eaten **fish** since giving birth?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once since giving birth (1)
Oily fish (e.g. salmon, tuna, mackerel, sardines)	○	○	○	○	○
White fish (e.g. cod, bass, snapper, lemon fish)	○	○	○	○	○

Page Break

15 **Seafood and shellfish**

How often have you eaten **seafood and shellfish** since giving birth?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once since giving birth (1)
Crustaceans (e.g. shrimp, crab, prawns, lobster)	○	○	○	○	○
Mollusks (e.g. clams, oysters, mussels, scallops, octopus, squid)	○	○	○	○	○

Page Break

16 **Legumes, nuts and seeds**

How often have you eaten **legumes, nuts and seeds** since giving birth?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once since giving birth (1)
Legumes (e.g. chickpeas, lentils, butter beans)	○	○	○	○	○
Nuts or nut butters (e.g. almonds, brazil nuts, cashews, peanuts)	○	○	○	○	○
Seeds (e.g. pumpkin seeds, sunflower seeds)	○	○	○	○	○
Tofu	○	○	○	○	○

Page Break

17 **Grains**

How often have you eaten **grains** since giving birth?

Note: *please assume all foods below include options for special diets, e.g. gluten-free.*

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once since giving birth (1)
Breads	○	○	○	○	○
Breakfast cereals	○	○	○	○	○
Rice, pasta or noodles	○	○	○	○	○
Other grains (e.g. couscous, quinoa, polenta)	○	○	○	○	○
Wholegrain versions of the above foods	○	○	○	○	○

Page Break

18 **Milk and milk alternatives**

How often have you consumed milk and milk alternatives since giving birth?

	Never (0)	Most days (4)	At least once per week (3)	At least once a month (2)	At least once since giving birth (1)
Low fat cow’s milk	○	○	○	○	○
Full fat cow's milk	○	○	○	○	○
Non-fortified milk alternatives (e.g. almond, rice, soy)	○	○	○	○	○
Calcium-fortified milk alternatives (e.g. almond, rice, soy)	○	○	○	○	○

Page Break

19 **Yoghurt and dairy foods**

How often have you eaten yoghurt and dairy foods since giving birth?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once since giving birth (1)
Yoghurt (plain, unsweetened)	○	○	○	○	○
Yoghurt (flavoured varieties)	○	○	○	○	○
Ice cream (all varieties)	○	○	○	○	○

Page Break

20 **Cheese**

How often have you eaten cheese since giving birth?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once since giving birth (1)
Strong flavoured cheese (e.g. blue, aged, feta, halloumi, swiss, parmesan, tasty)	○	○	○	○	○
Mild flavoured cheese (e.g. brie, camembert, mozzarella, ricotta, cottage, gouda)	○	○	○	○	○
Cream cheese, cheese spreads	○	○	○	○	○

Page Break

21 **Sea vegetables**

How often have you eaten **seaweed** since giving birth?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once since giving birth (1)
Brown seaweed (kelp, kombu, wakame, arame, quandai-cai, hiziki, sargassum, fusiforme, nori, karengo)	○	○	○	○	○
Green or red seaweed (nori, karengo)	○	○	○	○	○

Page Break

22 **Herbs, spices and dressings**

How often have consumed these **herbs, spices and dressings** since giving birth?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once since giving birth (1)
Garlic	○	○	○	○	○
Ginger	○	○	○	○	○
Onion	○	○	○	○	○
Chilli (all varieties)	○	○	○	○	○
Curry (powder or paste)	○	○	○	○	○
Wasabi	○	○	○	○	○
Lemon or lime	○	○	○	○	○
Herbs (e.g. parsley, chives, oregano)	○	○	○	○	○
Salad dressing	○	○	○	○	○
Other, please specify:	○	○	○	○	○

Page Break



23 **Seasonings**

How often have you added these **seasonings** to your foods or drinks since giving birth?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once since giving birth (1)
Sugar (all varieties, including honey)	○	○	○	○	○
Salt (non-iodised)	○	○	○	○	○
Salt (iodised)	○	○	○	○	○
Pepper	○	○	○	○	○
Other, please specify:	○	○	○	○	○

Page Break

24 **Cakes and biscuits**

How often have you eaten these foods during since giving birth?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once since giving birth (1)
Cakes, slices, muffins (all sweet varieties)	○	○	○	○	○
Biscuits (all sweet varieties)	○	○	○	○	○

Page Break




25 **Drinks**

How often have you chosen to drink these items since giving birth?

	Never (0)	Most days (4)	At least once a week (3)	At least once a month (2)	At least once since giving birth (1)
Water	○	○	○	○	○
Fruit juice (all varieties)	○	○	○	○	○
Complan, Sustagen (all varieties)	○	○	○	○	○
Hot chocolate, drinking chocolate, cocoa, Ovaltine, Nesquik, milo	○	○	○	○	○
Tea (all varieties)	○	○	○	○	○
Coffee (all varieties)	○	○	○	○	○

Page Break

25 Please choose the response that best describes you.

	Strongly agree (1)	Agree (2)	Somewhat agree (3)	Neither agree nor disagree (4)	Somewhat disagree (5)	Disagree (6)	Strongly disagree (7)
I have a 'sweet tooth', that is, I have a preference for sweet foods	○	○	○	○	○	○	○
I have a 'savoury palate', that is, I have a preference for salty, spicy or less sweet foods	○	○	○	○	○	○	○

Page Break

26 Is there anything else that you would like to tell us about your food and drink choices since giving birth?

_____

End of Block: ID

Appendix J: Lactation food choices questionnaire

Block: Default Question Block (1 Question)
Standard: Grouping question (2 Questions)
Block: Food choices (22 Questions)

Page Break

Start of Block: Default Question Block

Breastfeeding Food Choices Questionnaire

Thank you for taking the time to complete this questionnaire.
It should take approximately **15 minutes** to complete.

This is **not a test**. Your answers will help us learn about food choices while breastfeeding.

If you have any questions, please contact:
Kimberley Brown on [redacted] | K.Brown1@massey.ac.nz
or Dr Cath Conlon on 09 4140800 ext. 43658 | C.Conlon@massey.ac.nz

All information in this questionnaire will be kept confidential.

Committee Approval Statement
This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern A, Application SOA 18/56. If you have any concerns about the conduct of this research, please contact Dr Lesley Batten, Chair, Massey University Human Ethics Committee: Southern A, telephone + 64 6 356 9099 ext 85094, email humanethicsoutha@massey.ac.nz.

Page Break

End of Block: Default Question Block

Start of Block: Grouping question

Q1 Please enter your participant number:

_____

Note: this number was sent to you in the email with the questionnaire links. It will be used to match up data sets, not to personally identify you.

Page Break

End of Block: Grouping question

Start of Block: Food choices

Food choice intro

Food Choices

The following questions ask about your food and drink choices since giving birth.

1a Which of the following foods and/or drinks have you avoided since giving birth? Please select all that apply.

Note: *please assume all foods listed have been served cold or warm, that is, below 70 ºC.*

- ☐ Processed meats (e.g. pâté, salami, ham and luncheon) (1)
- ☐ Cold pre-cooked meat such as chicken (plain or smoked) and corned beef (2)
- ☐ Raw (unpasteurised) milk and raw milk products (3)
- ☐ Soft pasteurised cheese (e.g. brie, camembert, feta, blue, mozzarella and ricotta) (4)
- ☐ Ready-made salads (5)
- ☐ Hummus (6)
- ☐ Tahini (7)
- ☐ ⊗ I have not avoided any food and/or drinks (8)
- ☐ ⊗ Choose not to answer (9)

Page Break

1b

Which of the following foods and/or drinks have you avoided since giving birth? *Please select all that apply.*

Note: *please assume all foods listed have been served cold or warm, that is, below 70 ºC.*

- ☐ Raw, smoked or pre-cooked fish or seafood (including sushi, smoked salmon, marinated mussels or oysters) (1)
- ☐ Foods containing raw egg (e.g. smoothies, mayonnaise, hollandaise sauce or desserts such as mousse) (2)
- ☐ Soft-serve ice cream (3)
- ☐ Cream or custard (including pre-made cakes or pastries) (4)
- ☐ Alcohol (5)
- ☐ ⊗ I have not avoided any food and/or drinks (6)
- ☐ ⊗ Choose not to answer (7)
- ☐ Other, please specify: (8) _____

Skip To: 2a If 1b = 6

Page Break

1c For what reason/s have you **avoided** these foods since giving birth? *Please select all that apply.*

- ☐ I was told by a health professional (1)
- ☐ I was told by a family member or friend (2)
- ☐ My religion/beliefs (3)
- ☐ Following New Zealand breastfeeding guidelines (4)
- ☐ Following internet, book, newspaper, or magazine advice (5)
- ☐ Food safety concerns (6)
- ☐ These foods or drinks cause nausea/vomiting (7)
- ☐ I have an allergy or food intolerance (8)
- ☐ I dislike these foods or drinks (9)
- ☐ ⊗ Not sure (10)
- ☐ ⊗ Choose not to answer (11)
- ☐ Other, please specify: (12) _____

Page Break

2a

Which of the following foods/drinks have you **increased consumption** since giving birth? *Please select all that apply.*

- ☐ Dairy products (1)
- ☐ Sardines (2)
- ☐ Salmon (3)
- ☐ Leafy green vegetables (4)
- ☐ Fortified cereals (added nutrients, e.g. iron) (5)
- ☐ Meat (6)
- ☐ Nuts (7)
- ☐ Tofu (8)
- ☐ ⊗ I have not added any new foods to my diet (9)
- ☐ ⊗ Choose not to answer (10)
- ☐ Other, please specify: (11) _____

Skip To: 4a If 2a = 9

Page Break

2b For what reason/s have you **increased consumption** of these foods/drinks since giving birth? *Please select all that apply.*

- ☐ I was told by a health professional (1)
- ☐ I was told by a family member or friend (2)
- ☐ Following the New Zealand breastfeeding guidelines (3)
- ☐ Following internet, book, newspaper, or magazine advice (4)
- ☐ Food cravings (5)
- ☐ For my baby's health (6)
- ☐ To get more iron and/or calcium in my diet (7)
- ☐ ⊗ Choose not to answer (8)
- ☐ Other, please specify: (9) _____

Page Break

3a Which of the following foods have you **limited** (e.g. no more than once per week) since giving birth? *Please select all that apply.*

- ☐ Cooked Bluff or Pacific oysters, or queen scallops (1)
- ☐ Canned fish (like tuna, salmon or sardines), terakihi, blue cod, hoki, john dory, monkfish, warehou, flounder and whitebait (2)
- ☐ Longer-lived and larger fish (e.g. farmed salmon, snapper, uncanned albacore tuna and mackerel, as well as kahawai, red cod, orange roughy and ling) (3)
- ☐ Deep-sea or lake fish (e.g. school shark, southern bluefin tuna, marlin, and trout) (4)
- ☐ Brown seaweed (kelp, kombu, wakame, arame, quandai-cai, hiziki, sargassum, fusiforme) (5)
- ☐ Green or red seaweed (nori, karengo) (6)
- ☐ ⊗ I have not limited any of the above foods (7)
- ☐ ⊗ Choose not to answer (8)

Skip To: 4a If 3a = 7

Page Break

3b For what reason/s have you **limited** these foods since giving birth?

- [ ] Mercury content in fish (1)
- [ ] Cadmium content in oysters and scallops (6)
- [ ] Iodine content in seaweed (3)
- [ ] I don't eat these foods (10)
- [ ] ⊗ Choose not to answer (9)
- [ ] Other, please specify: (8) _____

Page Break

4a Which of the following vitamins and/or mineral supplements have you taken since giving birth?

Note: *supplements listed below include multivitamins containing folate or iodine, e.g. Elevit.*

- [ ] Folic acid (1)
- [ ] Iodine (2)
- [ ] ⊗ None of the above (3)
- [ ] ⊗ Choose not to answer (4)

Page Break

Display This Question:

If 4a = 1

4b For what reason/s did you take **folic acid** supplements? *Please select all that apply.*

- ☐ I was told by a health professional (1)
- ☐ I was told by a family member or friend (2)
- ☐ Following the New Zealand breastfeeding guidelines (3)
- ☐ Following internet, book, newspaper, or magazine advice (4)
- ☐ ⊗ Not sure (5)
- ☐ ⊗ Choose not to answer (6)
- ☐ Other, please specify: (7) _____

Display This Question:

If 4a = 2

4c For what reason/s did you take **iodine** supplements? *Please select all that apply.*

- ☐ I was told by a health professional (1)
- ☐ I was told by a family member (2)
- ☐ I was told by a friend (3)
- ☐ Following the New Zealand breastfeeding guidelines (4)
- ☐ Following internet, book, newspaper, or magazine advice (5)
- ☐ Blood tests confirmed a deficiency (6)
- ☐ ⊗ Not sure (7)
- ☐ ⊗ Choose not to answer (8)
- ☐ Other, please specify: (9) _____

Page Break

5a Have you taken other vitamin and/or mineral supplements since giving birth?

- ○ Yes, please specify: (1) _____
- ○ No (2)
- ○ Choose not to answer (3)

Skip To: 6a If 5a = 2
Skip To: 6a If 5a = 3

5b For what reason/s did you take these other vitamins and/or mineral supplements? *Please select all that apply.*

- ☐ I was told by a health professional (1)
- ☐ I was told by a family member (2)
- ☐ I was told by a friend (3)
- ☐ Following the New Zealand breastfeeding guidelines (4)
- ☐ Following internet, book, newspaper, or magazine advice (5)
- ☐ Blood tests confirmed a deficiency (6)
- ☐ ⊗ Not sure (7)
- ☐ ⊗ Choose not to answer (8)
- ☐ Other, please specify: (9) _____

Page Break

6a Whose advice has had the **greatest** influence on the foods and/or drinks you choose while breastfeeding? *Please select one.*

- ○ Family (1)
- ○ Friends (2)
- ○ GP/ family doctor (3)
- ○ Midwife (4)
- ○ Obstetrician (5)
- ○ Alternative health practitioner (6)
- ○ Antenatal class (7)
- ○ Internet (8)
- ○ Radio (9)
- ○ Television (TV) (10)
- ○ Books, magazines, and/or newspaper (11)
- ○ New Zealand breastfeeding guidelines (12)
- ○ ⊗ Not sure (13)
- ○ ⊗ Choose not to answer (14)
- ○ Other, please specify: (15) _____

Skip To: 7 If 6a = 14
Skip To: 7 If 6a = 13

Page Break

6b What advice have you received from this place or person regarding your diet while breastfeeding? *Please select all that apply.*

- ☐ Foods to **consume** (1)
- ☐ Drinks to **consume** (2)
- ☐ Foods to **avoid or limit** (3)
- ☐ Drinks to **avoid or limit** (4)
- ☐ How much food to consume (5)
- ☐ Supplements to take (6)
- ☐ Weight gain since giving birth (7)
- ☐ Weight loss since giving birth (11)
- ☐ Why the diet during breastfeeding is important (8)
- ☐ ⊗ Choose not to answer (9)
- ☐ Other, please specify: (10) _____

Page Break

7 Which of the following handouts have you **used**? *Please select all that apply.*

- ☐ 1. Eating for healthy pregnant woman (1)
- ☐ 2. Healthy mums: your guide to eating well during pregnancy and breastfeeding (2)
- ☐ 3. Food safety: avoiding listeria (3)
- ☐ 4. Alcohol and pregnancy: what you might not know (4)
- ☐ 5. Drinking and your baby (5)
- ☐ 6. Food safety in pregnancy (6)
- ☐ ⊗ I have not used any of these handouts (7)
- ☐ ⊗ Choose not to answer (8)

Page Break

8 Who have you received nutrition-related support for breastfeeding from?

	Yes (1)	No (2)	Choose not to answer (3)
Lead maternal carer (LMC) (1)	○	○	○
Plunket (8)	○	○	○
Health professional/s (2)	○	○	○
Family or friends (3)	○	○	○
Another parent/s (5)	○	○	○
Internet (4)	○	○	○
Television (9)	○	○	○
Radio (10)	○	○	○
Books, magazines and/or newspaper (11)	○	○	○
New Zealand breastfeeding guidelines (12)	○	○	○
Other (6)	○	○	○

Page Break

Display This Question:

If 8 = 6 [1]

8a Who/ where else have you received nutrition-related support for breastfeeding from?

_____

Page Break

8b What nutrition-related information for breastfeeding have you received from these people/ places? *Please select all that apply.*

- ☐ What foods to eat (1)
- ☐ What foods not to eat (2)
- ☐ The importance of your diet during breastfeeding (3)
- ☐ Breastfeeding energy requirements (4)
- ☐ ⊗ Choose not to answer (5)
- ☐ Other (please specify) (6) _____

Page Break

9 How long do you intend on breastfeeding?

- ○ No longer (1)
- ○ Until my baby is 3-6 months old (3)
- ○ Until my baby is 7-12 months old (2)
- ○ Until my baby is 13-18 months old (4)
- ○ Until my baby is 18 months or older (5)
- ○ Until my baby stops wanting to feed (6)
- ○ Until I return to work (8)
- ○ Other (please specify) (7) _____

Page Break

9a For what reasons do you intend on breastfeeding for this length of time? *Please select all that apply.*

- [ ] To bond with my baby (1)
- [ ] Breast milk is the best source of food for my baby (2)
- [ ] I was told by a health professional (3)
- [ ] I was told by a family member or friend (4)
- [ ] Following the New Zealand breastfeeding guidelines (5)
- [ ] Following internet, book, newspaper, or magazine advice (6)
- [ ] Handouts from a health professional (please specify handout name) (7) _____
- [ ] ⊗ Not sure (8)
- [ ] ⊗ Choose not to answer (9)
- [ ] Other (please specify) (10) _____

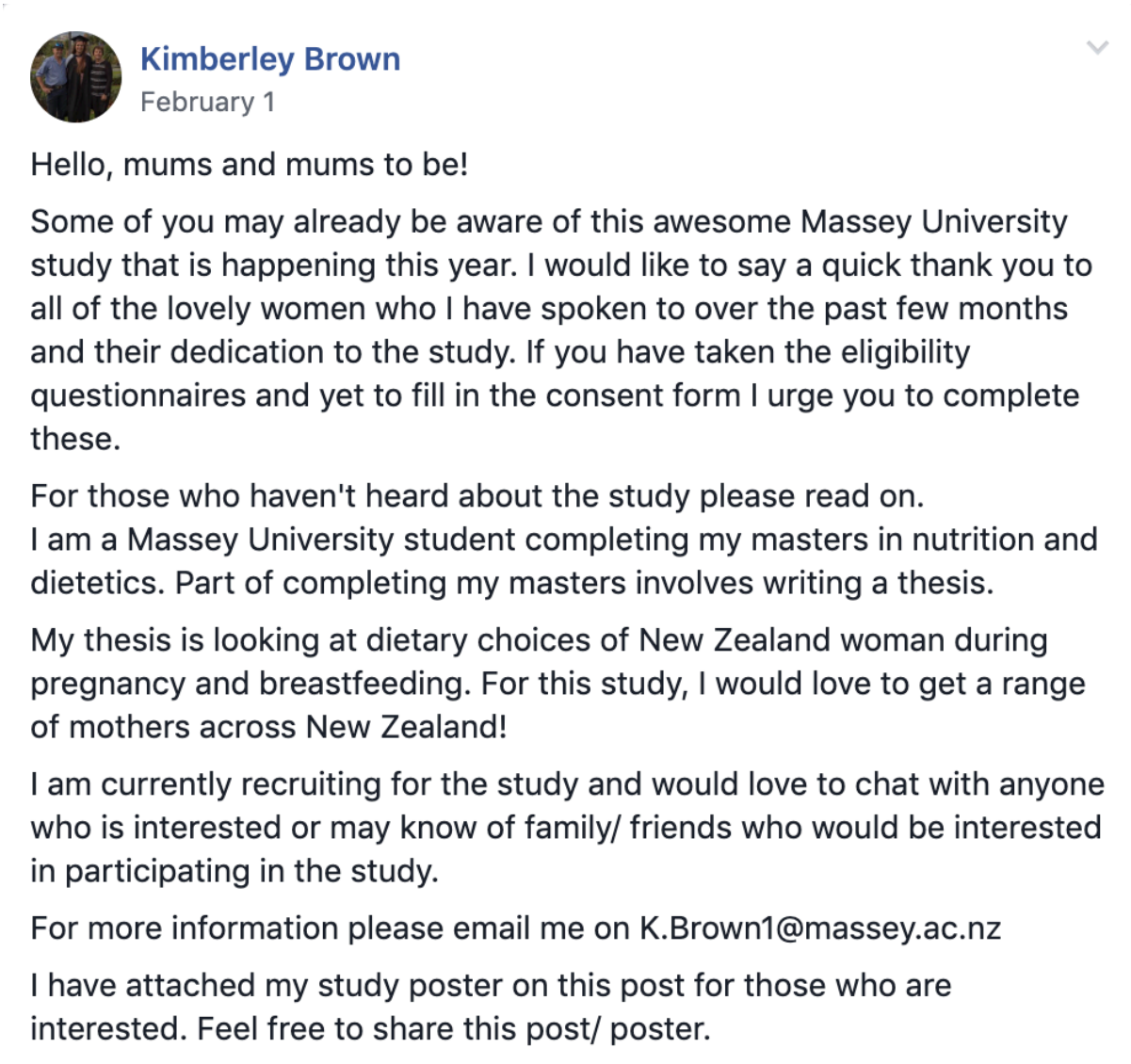
Page Break

10 Is there anything else that you would like to tell us regarding your diet since giving birth?

_____

End of Block: Food choices

Appendix K: Examples of recruitment posts on Facebook



Kimberley Brown
February 1

Hello, mums and mums to be!

Some of you may already be aware of this awesome Massey University study that is happening this year. I would like to say a quick thank you to all of the lovely women who I have spoken to over the past few months and their dedication to the study. If you have taken the eligibility questionnaires and yet to fill in the consent form I urge you to complete these.

For those who haven't heard about the study please read on.
I am a Massey University student completing my masters in nutrition and dietetics. Part of completing my masters involves writing a thesis.

My thesis is looking at dietary choices of New Zealand woman during pregnancy and breastfeeding. For this study, I would love to get a range of mothers across New Zealand!

I am currently recruiting for the study and would love to chat with anyone who is interested or may know of family/ friends who would be interested in participating in the study.

For more information please email me on K.Brown1@massey.ac.nz

I have attached my study poster on this post for those who are interested. Feel free to share this post/ poster.

Kimberley Brown
May 18

Hello, mums and mums to be!

Some of you may already be aware of this awesome Massey University study that is recruiting woman who are currently pregnant or have a baby less than 6 months of age.

I would like to say a quick thank you to all of the lovely women who I have spoken to over the past few months and their dedication to the study. If you are reading this and already taken the eligibility questionnaires but yet to fill in the consent form I urge you to complete these, you may need to check your junk mail if you have not received my emails.

For those who haven't heard about the study please read on.

I am a Massey University student completing my masters in nutrition and dietetics. Part of my masters studies involves writing a thesis.
My thesis is looking at dietary choices of New Zealand woman during pregnancy and breastfeeding (and no you do not need a "perfect diet" to take part).

I would love to get a range of woman who live in different parts of New Zealand to take part in the study. The best part is you can take part by completing the questionnaires on your cell phone or computer.

Recruitment for the study is happening now and I would love to chat with anyone who is interested or may know of family/ friends who would be interested in participating in the study.

Another note is that the wider study has also started recruitment. This part of the study is recruiting Auckland mums who have infants between 4-6 months and have not started solid feeding. If you are interested please have a look at the study website and follow the links to complete an eligibility questionnaire: https://www.vegesfirststudy.co.nz/.

Appendix L: Manuscript for publication

Dietary choices of New Zealand women during pregnancy and lactation

Original article

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Abstract

Aim: To explore New Zealand women's dietary choices, food safety practices, and sources of nutrition information during pregnancy and lactation.

Methods: Women were recruited during pregnancy or within 6 months postpartum and completed questionnaires on dietary choices, food safety, and sources of nutrition information.

Results: Women (n=458) from around NZ participated in the study. They consumed a wide range of foods and beverages and reported various dietary changes. In pregnancy women most commonly reported avoiding alcohol (92%), raw milk and milk products (86%), and raw/smoked/precooked seafood or fish (84%). Food avoidance was less common in lactation. However, fewer women consumed milk products during lactation (64%) than pregnancy (93%). Women also increased or added (69% pregnancy, 52% lactation) and limited (81% pregnancy, 66% lactation) foods. High-risk foods and drinks were mostly avoided during pregnancy such as alcohol and raw foods because of advice from the NZ pregnancy guidelines (88%) or because of food safety concerns (68%). Dietary information was acquired from a range of sources. During pregnancy, more reliable sources were used including midwives (37%) and NZPBG (25%). Potentially unreliable sources were used more frequently in lactation including alternative health practitioners (26%) and family/friends (12%).

Conclusion: Women are likely to alter their diet during pregnancy following advice from the

NZ pregnancy guidelines, health professionals, or because of food safety concerns. Lactating women often make dietary changes because of infant symptoms or advice received from potentially less reliable sources.

Health and nutrition concerns of women, particularly those for the growing fetus/ infant, often become more prominent during pregnancy and lactation.[1] Women frequently report changing their diet to achieve the best possible outcomes.[2,3,4] Evidence-based guidelines in NZ *"Food and Nutrition Guidelines for Healthy pregnant and breastfeeding women"* (NZPBG) developed by the Ministry of health in 2006 promote food and lifestyle based recommendations.[5] Compared to non-pregnant and non-lactating women food-based recommendations change to meet altered nutrient requirements during pregnancy and lactation. Women are recommended to consume additional servings of vegetables, dairy products, protein, and grain foods.[5]

There is a wealth of food safety advice for pregnant women because of the increased risk of foodborne illness.[6-9] Food safety recommendations are therefore particularly complex and comprehensive. Women have an increased susceptibility to listeriosis, toxoplasmosis, salmonella, botulism, influenza, varicella, and methyl mercury toxicity during pregnancy.[6-9] Alongside increased susceptibility, women also have an increased risk of infection severity, miscarriage, premature birth, still-birth, and fetal and maternal mortality. [6,8,10,11] High-risk foods that have been identified include soft cheeses, cold deli salads, cold cooked or smoked meats, processed meats, raw products, soft-serve ice cream, tahini, and ready-to-eat meals.[5,11,12]

Evidence from NZ and elsewhere suggests that women are likely to avoid a variety of foods during their pregnancy based on the advice they receive from health professionals.[4,13,14] Whether women who are breastfeeding continue to avoid a variety of foods is less well understood. Dietary advice during pregnancy and lactation is important to support the recommended dietary changes.[5] Previous studies have identified midwives, general practitioners (GP), printed media, friends, and family as common nutrition information sources.[15] This study aimed to determine women's dietary choices, food safety practices, and

sources of nutrition information during pregnancy and lactation. This evidence is important to understand what support future women require to make optimal dietary choices during pregnancy and lactation.

Methods

This cross-sectional, observational study recruited pregnant and lactating women throughout NZ. To meet the inclusion criteria women were required to be pregnant or within six months postpartum. Recruitment was conducted between January and June 2019 via social media, professional associations, posters, word of mouth, and personal contact. Participants were self-selected and therefore not representative of the NZ population. The questionnaires were developed by the research team of registered nutritionists and dietitians to align with the current NZPBG.[4] Questionnaires from the growing up in NZ study (GUiNZ) provided some guidance for question flow and wording.[16,17] Validated food frequency questionnaires (FFQ) and dietary recommendations from the Ministry of Primary industries and the NZPBG guided foods that were included in the questionnaires. Pilot testing was conducted with 14 pregnant women and women who had recently given birth. Pilot testing resulted in minor wording changes to increase readability.

Demographic information included health status, parity, food security, age, ethnicity, qualifications, and geographical location (Appendix F). Demographic information was collected at the beginning of the questionnaire. Food choice questionnaires (FCQ) (Appendix H and J) explored avoidance, addition, and limitation of foods, supplement use, and information sources. The FFQ's (Appendix G and I) explored women's daily, weekly, monthly, and occasional consumption of fruit, vegetables, protein foods, dairy, grains, and beverages. These questionnaires explored women's food choices and food variety and were not designed as a complete dietary assessment. Portion sizes and number of servings were not included.

The questionnaires took approximately 10-15 minutes to complete. Questionnaires favoured closed questions to maximise responses. Open questions were used to allow women to express additional information. This qualitative data has been used to provide further

justification where appropriate. The option of “choose not to answer” was provided to skip questions. Ethical approval to conduct this study was gained from the Massey University Human Ethics Committee (MUHEC): Southern A (application 28/09). Statistical analysis was conducted using IBM SPSS statistics (version 24.0). Descriptive statistics, including mean, standard deviation, frequency, and percentage were calculated through multiple response sets and custom tables. Chi-squared tests were used to compare women’s education level and alcohol intake. The homogeneity of the sample demographics did not allow an analysis of factors influencing dietary intake.

Results

All participants who completed allocated questionnaires were included in the analysis (n=458). The pregnancy FFQ was completed by all women and 442 completed the FCQ. Of women who completed the pregnancy questionnaires, 182 took part during their pregnancy and the remaining 276 completed them retrospectively. Eligible women (n=290) then completed the lactation FFQ (n=290) and FCQ (n=284). Respondents were largely well-educated European women with adequate food availability (96%) from all around NZ (Table 1, Figure 1). Women mostly reported good health before pregnancy (94%). Thirty-one-percent of women reported a change in their health during pregnancy, the majority (83%) felt that their health status declined. Iron deficiency and heartburn were the most common diagnoses (Table 1).

Table 1. Participant characteristics

		Total n (%)
Participants		458 (100%)
Mean age (years ± SD)		32.5 ± 6
Ethnicity (Multiple responses allowed)	NZ European	433 (95%)
	Māori	42 (9%)
	Pacific Island	18 (4%)
	Asian	23 (5%)
	Other *	33 (7%)
Qualification	Secondary	77 (17%)
	Tertiary	380 (83%)
First baby	No	261 (57%)
Number of children	One	192 (74%)
	Two or more	68 (26%)
	Choose not to answer	1 (0%)
Diagnosis during pregnancy (multiple responses allowed)	Iron deficiency	219 (48%)
	Anaemia	29 (6%)
	Heartburn	160 (35%)
	Gestational diabetes	23 (5%)
	High blood pressure	17 (4%)
	Other #	45 (10%)

*Other ethnicities: African, South African, British, Kurdish, Latin American, Russian, Scottish

Other diagnoses: Hyperemesis gravidarum, pre-eclampsia, cholestasis, fibroids, hypothyroidism, morning sickness, prolapsed disc, low platelets, tachycardia, constipation, polyhydramnios, B12 deficiency, thrush

Figure 1. Geographical spread of cohort

Dietary choices

Women consumed a range of foods during pregnancy and lactation (Table 2). Women added or increased foods in pregnancy (69%) and lactation (53%) (Table 3). Most commonly dairy products, nuts, and green leafy vegetables were added. Women's reasons for adding or increasing foods were to increase dietary iron and/or calcium (52%), food cravings (49%), and to support baby's health (46%). During lactation, the most common reasons were to support their baby's health (42%), increase dietary calcium and/or iron (36%), and food cravings (29%). In pregnancy (88%) and lactation (70%), women reported avoiding foods, including alcohol, raw milk and milk products, raw, smoked or pre-cooked fish or seafood (Table 4). The main reason for avoidance during both pregnancy (88%) and lactation (48%) was following the NZPBG. Other reasons in pregnancy were because of advice from health professionals (68%), advice from internet/magazine/book/newspaper (36%), and advice from family or friends (27%). During lactation avoidance reasons included advice from health professionals (28%), food preferences (26%), and food safety concerns (12%). Food limitation was more common during pregnancy (81%) than lactation (66%) (Table 5). Women limited food in pregnancy because of mercury concerns (35%), food preferences (35%), and cadmium concerns (6%). In lactation dislike of foods (25%), and mercury concerns (7%) were the most common reasons.

Women's dietary choices were affected by a variety of factors. In pregnancy women frequently commented that nausea, previous pregnancy complications, or IVF pregnancies

influenced food choices. Women's diets were more relaxed when suffering from nausea and were stricter if conception was difficult.

"This pregnancy is a result of IVF after years of infertility. Anxiety-related to this may have caused me to be even more cautious than I might have been otherwise".

Common influences during lactation included tiredness, inability to prepare food due to limited time, and baby's symptoms.

"Time to eat well is very difficult. Getting a variety of foods each day is so hard with a new-born!"

"The biggest change in my diet is that I am eating way more store-bought products rather than making them myself (e.g. muesli bars, bliss balls, muesli, sauces, nut butter etc). This is mainly to save time and energy".

Table 2. Foods and beverages consumed daily during pregnancy and lactation

Daily food group consumption	Pregnancy n (%)	Lactation n (%)
Dairy		
Milk	428 (93%)	187 (64%)
Milk alternatives	73 (16%)	73 (25%)
Yoghurt	213 (47%)	100 (34%)
Cheese	116 (25%)	96 (33%)
Ice cream	34 (7%)	24 (8%)
Protein		
Red meat	189 (41%)	151 (52%)
Poultry	230 (50%)	148 (51%)
Fish	23 (5%)	14 (5%)
Legumes	52 (11%)	41 (14%)
Nut or nut butters	211 (46%)	149 (51%)
Seeds	126 (28%)	92 (32%)
Tofu	8 (2%)	6 (2%)
Grains		
Bread	376 (82%)	245 (84%)
Breakfast cereals	273 (60%)	159 (55%)
Fruit and vegetables		
Fruit	404 (88%)	241 (83%)
Vegetables	410 (89%)	258 (89%)
Beverages		
Water	451 (98%)	283 (98%)
Tea	222 (48%)	136 (47%)
Coffee	193 (42%)	146 (50%)

Table 3. Foods and drinks added or increased in the diet during pregnancy and lactation

Foods added or increased	Pregnancy n (%)	Lactation n (%)
Dairy products	211 (48%)	66 (23%)
Nuts	136 (31%)	75 (26%)
Green leafy vegetables	130 (29%)	68 (24%)
Meat	84 (19%)	39 (14%)
Salmon	56 (13%)	31 (11%)
Fortified cereals	58 (13%)	36 (13%)
No additions	139 (31%)	134 (47%)
Other *	42 (10%)	23 (8%)

* Pregnancy: spirulina, peanut butter, eggs, confectionary, celery, seeds, tomato, bread, fruit, jalapenos, iron rich foods, bran, Quorn, orange juice, white fish, porridge, seaweed, avocado, vegetables, fruit, herbal tea, olives, dates, tofu, sardines, water
Lactation: oats, flaxseeds, alcohol, sushi, meal replacement drinks, brewer's yeast, tofu, sardines, water

Table 4. Foods and beverages avoided in the diet during pregnancy and lactation

Foods and drinks avoided	Pregnancy n (%)	Lactation n (%)
Alcohol	408 (92%)	176 (62%)
Raw (unpasteurised) milk and milk products	379 (86%)	99 (35%)
Raw, smoked, or precooked fish or seafood	371 (84%)	57 (20%)
Cold precooked meats	335 (76%)	39 (14%)
Processed meats	315 (71%)	42 (15%)
Ready-made salads	313 (71%)	28 (10%)
Tahini	300 (68%)	29 (10%)
Foods containing raw egg	296 (67%)	24 (8%)
Soft-serve ice cream	288 (65%)	37 (13%)
Hummus	255 (58%)	16 (6%)
Soft pasteurised cheese	232 (52%)	35 (12%)
Cream or custard	212 (48%)	29 (10%)
No foods or drinks avoided	52 (12%)	84 (30%)
Other*	13 (3%)	12 (4%)
* Pregnancy: mayonnaise, sprouts, coffee, caffeine, eggs. Lactation: caffeinated coffee, onion, spicy food, dairy products, chocolate		

Table 5. Foods limited in the diet during pregnancy and lactation

Foods limited in diet	Pregnancy n (%)	Lactation n (%)
Canned fish	160 (36%)	36 (13%)
Bluff or Pacific oysters or Queen scallops	136 (31%)	43 (15%)
Longer lived and larger fish	130 (29%)	30 (11%)
Deep sea or lake fish	128 (29%)	33 (12%)
Brown seaweed	128 (29%)	37 (13%)
Red or green seaweed	118 (27%)	39 (14%)
No limitations	85 (19%)	97 (34%)
Choose not to answer	17 (4%)	8 (3%)

Milk and milk products

Daily consumption of cow's milk was more commonly reported in pregnancy than lactation (Table 2). Lactating women reported avoiding milk products because of a belief that dairy caused infant colic, reflux, or allergic symptoms, or following advice from health professionals, family or friends, or information sourced from the internet.

"Have now cut out dairy from diet for baby not confirmed issue but precaution due to reflux and colic"

"Trying to be dairy-free for my bubs".

Women who chose milk alternatives also more frequently reported choosing non-fortified milk alternatives (52% in pregnancy and 56% lactation).

Protein foods

Women consumed a range of protein sources (Table 2). Some women who followed meat-free diets commented that they had added sources of animal protein to their diet during pregnancy.

"Prior to being pregnant I was vegan, I am no longer vegan and will go back to being vegan once I am done breastfeeding"

"Pre-pregnancy I mainly ate a vegetarian (pescatarian) diet as my husband is a vegetarian. I have been trying to increase my consumption of meat since becoming pregnant".

Oily fish (salmon, tuna, mackerel, and sardines) was consumed at least once a week by a third of both groups (Table 6). Women frequently commented that they increased their fish intake, however, only 13% increased their intake of salmon (Table 3).

"*I spent the first-trimester vegan but then relaxed and became vegetarian. Over the last month (roughly) I began to eat a small amount of fish".*

Table 6. Meat and fish consumed at least once a week during pregnancy and lactation

Food group consumption at least once a week	Pregnancy n (%)	Lactation n (%)
Fish	201 (44%)	135 (47%)
Red meat	201 (44%)	106 (37%)
Poultry	165 (36%)	108 (37%)

Fruit, vegetables, grains and beverages

Both groups consumed a wide range of fruit, vegetables, grains, and beverages (Table 2). Women often reported their fruit and vegetable choices were influenced by seasonality. Women most frequently consumed three types of fruit and three types of vegetables daily in pregnancy. In lactation, women reported consuming two types of fruit and five types of vegetables daily. Both pregnant (82%) and lactating (84%) women consumed bread daily. Wholegrain versions were chosen by 29% pregnant and 39% of lactating women. Caffeine-containing beverages were consumed daily by approximately half of women in both groups (Table 2). Women were aware of caffeine recommendations and commonly reported avoiding caffeine entirely or choosing decaf versions rather than limiting intake.

"*I have drunk decaf tea and coffee all pregnancy".*

Supplements

During pregnancy 96% of women took folic acid supplements, 95% took iodine supplements, and 70% took other supplements including iron, calcium, magnesium, fish oil, selenium, zinc, vitamin C, vitamin B complex, probiotics, and vitamin D. During lactation 26% continued taking folic acid supplements and 63% continued iodine supplements. Other supplements (60%) included garlic oil, fenugreek, Chinese herbs, evening primrose oil, spirulina, blessed thistle, brewer's yeast, selenium, collagen, and glucosamine. Various reasons for supplement use were reported (Table 7).

Table 7. Reasoning for taking supplements in pregnancy and lactation

Reasoning for taking supplements	Folic acid pregnancy n (%)	Folic acid lactation n (%)	Iodine pregnancy n (%)	Iodine lactation n (%)	Other pregnancy n (%)	Other lactation n (%)
Health professional's advice	396 (93%)	39 (52%)	388 (92%)	144 (81%)	201 (65%)	84 (49%)
Following NZPBG	254 (60%)	14 (19%)	221 (53%)	36 (20%)	103 (33%)	20 (12%)
Advice from family member or friend	53 (12%)	6 (8%)	44 (10%)	4 (2%)	50 (16%)	20 (12%)
Advice from internet, magazine, book, or newspaper	37 (9%)	4 (5%)	27 (6%)	4 (2%)	27 (9%)	17 (10%)
Blood tests confirmed a deficiency	NA	NA	11 (3%)	2 (1%)	28 (9%)	5 (3%)
Other*	15 (4%)	27 (36%)	10 (2%)	26 (15%)	76 (25%)	74 (43%)

*Pregnancy: lacking in diet (vegan, vegetarian), reduce morning sickness, instead of Elevit, increases fertility, common knowledge, took in previous pregnancy, always taken, tiredness, boost nutrition, overall health and energy

Lactation: lacking in diet (vegan, vegetarian) finishing off supplements, supporting milk supply, ensure dietary adequacy, post-partum haemorrhage, always taken, sleep, tiredness, boost nutrition, overall health and energy

Food safety practices

Women reported being aware of food safety recommendations and 68% purposely avoided food and beverages during pregnancy because of food safety concerns (Table 4). Additionally, 88% reported using NZPBG, which incorporates food safety recommendations. Some women (11%) did not avoid any foods or beverages. Women commented being more

relaxed about food safety and dietary choices during consecutive pregnancies because of limited time with multiple children, fatigue, or finding recommendations hard to adhere to.

"*I tried to eat as healthy as possible, the national food guidelines were helpful, I was surprised by the amount of food restrictions due to listeria risk"*

"Never ate anything considered to be a 'risk' food for pregnant women".

Information sources

Women's most influential information source varied between the groups (Table 8).

Table 8. Greatest influence on dietary choices

Greatest influence on dietary choices	Pregnancy n (%)	Lactation n (%)
Midwife	164 (37%)	86 (30%)
NZPBG	109 (25%)	30 (11%)
Family and friends	34 (8%)	35 (12%)
Internet	20 (5%)	23 (8%)
Obstetrician	22 (5%)	2 (1%)
GP	16 (4%)	8 (3%)
Books, magazines, and/or newspaper	6 (1%)	3 (1%)
Not sure	22 (5%)	13 (5%)
Alternative health practitioner	11 (2%)	74 (26%)
Other *	38 (9%)	10 (4%)

* Pregnancy: Antenatal classes, fast food advertisements, own professional background (GP or dietitian), own knowledge, no-one, appetite, common sense, dietitian/ nutritionist, nausea, pamphlets, choose not to answer

Lactation: Antenatal classes, lactation consultant, fast food advertisements, own professional background (GP or dietitian), own knowledge, no advice received, appetite, common sense, dietitian/ nutritionist, mixed sources, choose not to answer

Information about food and beverage avoidance was more commonly reported than what foods and drinks to consume in pregnancy (Table 9). In lactation, there were no clear trends.

Table 9. Advice received from information sources in pregnancy and lactation

Advice received	Pregnancy			Lactation		
	LMC advice n (%) n=361	NZPBG n (%) n=109	Antenatal class n (%) n=69	Midwife n (%) n=86	Alternative health practitioner n (%) n=74	Internet n (%) n=23
Foods to consume	243 (67%)	75 (69%)	47 (68%)	58 (67%)	53 (71%)	15 (65%)
Drinks to consume	172 (48%)	61 (56%)	34 (49%)	43 (50%)	32 (43%)	8 (35%)
Foods to avoid/limit	321 (89%)	108 (99%)	59 (86%)	51 (59%)	37 (50%)	14 (61%)
Drinks to avoid/limit	270 (75%)	100 (92%)	61 (88%)	52 (60%)	26 (21%)	13 (57%)
How much food to consume	76 (21%)	23 (21%)	12 (17%)	21 (24%)	21 (29%)	5 (22%)
Supplements to take	258 (71%)	55 (50%)	17 (25%)	45 (52%)	53 (71%)	8 (35%)
Weight changes	160 (44%)	32 (29%)	19 (28%)	16 (19%)	0	9 (39%)
Importance of the diet during pregnancy or breastfeeding	158 (44%)	47 (43%)	34 (49%)	41 (48%)	26 (36%)	12 (52%)
Other*	11 (3%)	0	2 (3%)	2 (2%)	0	0

*Pregnancy: how to avoid GDM, pamphlets, discouraged dieting, eat less fruit (too high in sugar), second pregnancy so did not discuss food in detail, morning sickness weight loss, drinks to lower blood pressure.

Lactation: baby symptoms, how to improve own diet to help baby, how to increase milk production

The majority of women chose midwives to be their LMC (92%), with 6% choosing an obstetrician, and 2% having shared care due to twin pregnancies. Dietary advice from LMCs

was received by 87% of women. Information received tended to focus on what not to do (Table 9). Antenatal classes were attended by 39% of women during pregnancy and 40% received dietary advice. Multiparous women reported attending antenatal classes in previous pregnancies which was why they did not attend classes. Other reasons for not attending classes were limited availability and timing. Many were scheduled to start classes in the approaching weeks. Women used a range of information sheets during pregnancy (Table 10). Food safety and general healthy eating handouts were more commonly used than alcohol-related handouts.

Table 10. Handouts used during pregnancy

Handouts used	Total n (%)
Food safety in pregnancy	238 (54%)
Eating for healthy pregnant women	178 (40%)
Food safety: avoiding listeria	155 (35%)
Alcohol and pregnancy: what you might not know	56 (13%)
Drinking and your baby	31 (7%)
Healthy mums: your guide to eating well during pregnancy	20 (5%)
No handouts used	116 (26%)

Lactating women reported the use of many potentially unreliable information sources (Table 11).

Table 11. Dietary information sources used during lactation

Lactation information sources	Total n (%)
Lead maternal carer	218 (77%)
Internet	190 (67%)
Family and/or friends	190 (67%)
NZPBG	129 (45%)
Plunket	125 (44%)
Other parents	124 (44%)
Health professional/s	93 (33%)
Books, magazines, and/or newspaper	87 (31%)
Television	8 (3%)
Radio	3 (1%)
Other*	13 (5%)
* osteopath, nutritionist, Facebook, dietitian, lactation consultant, our Health Visitor, Pacifica nurses, handouts, apps, birth care	

Discussion

In an effort to explore New Zealand women's dietary choices during pregnancy and lactation this study used questionnaires to investigate dietary choices, food safety practices, and sources of nutrition information. Women, in this geographically diverse, predominantly NZ European cohort, chose a variety of foods and beverages during pregnancy and lactation. The majority of participants were well educated, of good health and food secure, therefore this cohort is not representative of the NZ population. It does, however, represent women who are educated and food secure with potentially fewer barriers to making optimal dietary choices. [13,18]

Foods added or increased, limited, and removed (dietary changes)

Food addition/increase, limitation, and removal trends in pregnancy were similar to what was observed in GUiNZ. GUiNZ reported that 41% added and 87% avoided foods during pregnancy.[19] This was not dissimilar to the 48% added and 92% who avoided one or more foods or beverages in this study. Food limitation was not discussed in GUiNZ pregnant cohort, therefore this study provides new information that approximately 80% of women also limit their consumption of certain foods in pregnancy. This study also provides valuable information on foods being consumed during lactation. Nearly 50% of women did not add or increase foods, 70% avoided foods and/or beverages, and 66% limited foods. During lactation there are no recommendations for food and beverage avoidance, women are however recommended to limit their alcohol and caffeine intakes.[5] Considering the large proportion of lactating women who avoid and/or limit foods and beverages there is evidence to suggest women do not adhere to the current NZPBG recommendations. The reasoning for this is unclear, however communication of dietary recommendations and confusing messages could be possible reasons. Confusing messages have been identified within NZ's health information environment during pregnancy previously, suggesting possible reasoning for women not adhering to dietary recommendations during lactation.[19] Further research is required to distinguish why women avoid and limit foods in lactation.

Reasoning for dietary change

Women reported a variety of reasons for dietary changes including following the NZPBG, to increase dietary iron/ calcium, food cravings, food safety, to support babies' health, and because of advice from health professionals. Dietary choices were also impacted by other factors such as morning sickness and conception difficulty in pregnancy and fatigue and infant symptoms in lactation. A large proportion of women reported using the NZPBG when making dietary changes, justifying its importance. There are however limitations to the current NZPBG as they do not provide comprehensive recommendations for managing and making dietary changes, how to cope with fatigue when preparing meals, and how the maternal diet affects infant symptoms. Additionally, there is a lack of emphasis on what women can eat during pregnancy and lactation, which could account for more women removing and limiting foods than adding.

Milk and milk product consumption

Milk consumption was less commonly reported in lactation as women often feared they were causing infant discomfort. Women's consumption of calcium-fortified milk alternatives was also low, with over 50% of chosen milk alternatives being unfortified. Removing calcium sources, such as milk, without replacing with fortified alternatives increases a woman's risk of not meeting calcium recommendations during lactation.[5] In NZ milk is the highest dietary calcium source (27%) for all age groups and genders.[20]

There is evidence to suggest that maternal restriction of antigen foods, such as cow's milk and eggs, is beneficial for some infants suffering from atopic eczema.[21] The evidence supporting the protection from other allergies is weak, which supports the NZPBG recommendations that women should not purposely avoid foods.[22] Food avoidances could result in dietary deficiencies and increase the infant's risk of developing allergies. [5,21,22] Physiological changes, especially bone turnover, are protective of the infant's average procurement of 260mg/day of calcium at the mother's expense. [23,24] Women's bone mineral density (BMD) has been shown to decrease by 1-3% per month during lactation, exceeding postmenopausal loss of 1-3% per year.[23] Bone density is then regained once breastfeeding is ended and menstruation returns.[24] The current consensus suggests that bone loss is independent of maternal calcium intake and low calcium diets during lactation do not increase woman's risk of osteoporosis in later life.[25] BMD is however affected by breast milk output, which explains why women with multiple offspring have an increased bone mineral loss.[26] Exceptions have also been observed for adolescents who also require calcium for skeletal growth, or those with higher calcium requirements including multiple fetuses or those undergoing heparin treatment.[27,28] There is a lack of evidence about the long-term consequences of low calcium diets in lactation and the implications if low calcium diets are continued after lactation.[26,29-33] Because a significant proportion of women are avoiding calcium foods during lactation it is possible that the current calcium recommendations are not being met. Additionally, there is a significant amount of confusion surrounding the maternal diet and infant symptoms suggesting the need for further recommendations surrounding the benefits and consequences of food avoidance in lactation.

Protein, bread, fruit, vegetables, and caffeine consumption

Protein intakes were as expected with the main sources being poultry, red meat, and nuts/ nut butters. The trend of non-meat eaters choosing to add meat into the diet during pregnancy and lactation was interesting, particularly because the current guidelines suggest that a well-balanced vegetarian or vegan diet can meet nutritional and energy requirements.[5] More than 80% of women consumed bread daily during both pregnancy and lactation. It is expected that women, therefore, will be benefiting from NZ's iodine fortification of bread and would likely benefit from similar folate fortification schemes. Fruit and vegetable intake seems to vary depending on seasonality. The trends of seasonality emphasise further refining of the NZPBG are needed to ensure different micronutrient and food safety recommendations are met throughout the four seasons. Caffeine intake did not substantially differ between pregnancy and lactation with approximately half of women consuming caffeine beverages. There tended to be confusion about caffeine recommendations as women were very cautious of their consumption, often choosing decaf versions instead of the recommended limitation. [5]

Supplements

Folic acid and iodine are recommended to be supplemented in pregnancy. [5,34] In lactation, iodine is the only recommended supplement.[35] Supplement intake was higher than previously observed in NZ, with over 95% of women taking folic acid and iodine during pregnancy in this cohort. In 2018, 84% of 535 NZ women adhered to both folic acid and iodine intake during pregnancy.[36] In the same study, fewer women took iodine in lactation (63%). Iodine supplementation in pregnancy and lactation was higher than identified in a 2011 study (70% and 36% respectively), that took place soon after supplements were recommended, suggesting that more women are aware of iodine recommendations.[34] There is a lack of recommendations for iodine supplementation in the current NZPBG because guidelines have changed since the last update.[35] Inclusion of recommendations in a revised NZPBG may increase women's supplement use because a large number currently use the NZPBG when choosing supplements. A significant number of women took alternative supplements in both pregnancy (70%) and lactation (60%) because of advice from health professionals or following the NZPBG. There are currently no guidelines supporting the use of these supplements, suggesting that women require further evidence-based

recommendations about alternative supplements. Of the alternative supplements reported there is limited evidence to support beneficial effects to health. The use of alternative supplements, therefore, is unnecessary. Our results were similar to previous studies, suggesting alternative supplement use is commonly reported by women.[37]

Food safety practices

Similar to GUiNZ a large percentage of women were aware of food safety recommendations.[18] There were however differences in foods avoided, with more women avoiding high-risk foods and drinks in this study. These results also showed higher adherence to food safety recommendations than what was observed in South Auckland women in 2005.[38] Alcohol was the most commonly avoided substance during both pregnancy and lactation, yet a number (8%) of women continued to consume alcohol during pregnancy. The consequences of alcohol consumption are widely understood and NZPBG recommends avoiding alcohol.[5] In this study, there were differences in alcohol consumption between women's education level, with tertiary-educated women being 2x more likely to avoid alcohol. These discrepancies between alcohol consumption suggest that further alcohol-related pregnancy campaigns are required, particularly for those with secondary level education. The use of alcohol-related handouts was lower than other topics. This could explain why some women continue consuming alcohol.

Dietary information sources

Women acquired dietary information from a range of sources that were not dissimilar to sources identified in GUiNZ.[13] Midwives were the most influential information source during both pregnancy and lactation. It seems during pregnancy nutrition advice is commonly received from qualified health professionals, such as midwives. Although it was good women received dietary advice from midwives, midwives are currently not formally educated in nutrition in NZ.[39] Additionally, previous studies have reported that midwives lack knowledge around nutrition recommendations and do not feel confident giving nutrition advice, particularly for vegetarian women or those with health conditions.[39,40]

As women's dietary choices are often influenced by dietary advice from midwives, further strategies to improve midwives knowledge or the increased availability of nutrition

professionals would be warranted. Nearly the opposite was observed during lactation with the majority of women relying on alternative health practitioners, the internet, and friends/ family. The reasoning behind this difference in information procurement is likely because of the current nutrition NZPBG. The guidelines have a large emphasis on dietary recommendations during pregnancy, particularly food safety, but little on lactation. [5] Additionally, there is a change in health professionals available to women. LMC's will continue to care for women until 6 weeks postpartum, after which a Well-child provider will be available. Similar to midwives Well-child care providers are not formally trained to provide nutrition advice and nutrition education is not their key priority. [41] The lack of evidence-based support during lactation may be the reason for food removal trends. Information received from all sources was commonly about foods and beverages to avoid rather than what should be added or included in the diet. This was translated into more women removing and limiting than adding or increasing foods during pregnancy and lactation.

Women are recommended to increase their servings of food groups, however practical explanations of how recommendations can be met are not given. Instead, there is a large emphasis on the importance of removing specific high-risk foods such as alcohol and raw meats. [5] From previous studies, women found dietary recommendations easier to adhere to when foods were specifically mentioned. [42] Specifically mentioning the nutrients of concern, dietary requirements, and how to meet these requirements could be a way of improving the current recommendations. Nearly 60% of women already had children, which was a major factor for the limited use of antenatal classes. Women tended to attend antenatal classes during their first pregnancy and not in later pregnancies. Currently there are no regulations for the quantity or quality of nutrition advice given at antenatal classes, however, they may provide dietary advice. [43] Additionally, as attendance reduced during subsequent pregnancies in this study the importance of other mediums for evidence-based dietary information, particularly if recommendations change, is emphasised.

This study provides valuable information surrounding the dietary choices of 458 geographically diverse pregnant and lactating NZ women. Currently, evidence of women's dietary choices, food safety practices, and nutrition information sources is limited in NZ. This is particularly true for food choices in lactation. This cohort's demographics were a limitation

as women were predominantly European, highly educated, food secure, and of good health status. This is study is therefore not representative of the NZ population and disallowed comparisons between different ethnic and socioeconomic groups. Further research would be required to investigate differences between ethnicity and socioeconomic status.

Conclusion

Women make dietary changes during pregnancy and lactation including adding, limiting, and avoiding foods. Dietary changes in pregnancy were influenced by many reliable information sources such as NZPBG, health professionals, or because of food safety concerns. In lactation women more frequently received dietary advice from possibly less reliable sources such as alternative health practitioners, the internet, and friends and family. Other common reasons for dietary change in lactation were because of concerns about the impact of the maternal diet on infant symptoms. The lack of evidence-based information sources in lactation highlights the need for changes in how information is communicated to women during this time. Food safety practices were generally followed by women, however, there is room for improvement especially considering this cohort's highly educated demographics.

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