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Parental reporting of the feeding practices of infants in New Zealand

An observational study

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Victoria Arliss

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Abstract

Background: Term infants (≥ 37 weeks' gestation) have often been regarded as a homogenous group of neonates who do not have increased risks associated with their gestational age at birth. However there is growing evidence to suggest that infants born between 37 to 38 weeks and 6 days gestation (early term) are at increased risk of suboptimal short- and long-term health outcomes compared to infants born greater than 39 weeks' gestation. At present, a small number of studies have investigated the feeding practices of early term infants (ETIs) from birth until 12 months of age compared to full term infants (FTIs). The limited evidence available on the feeding practices of ETIs suggests that these infants are likely to have reduced breastfeeding durations. The reasons for the reduction in breastfeeding rates seen amongst ETIs have yet to be adequately explored.

Objective: The aim of this present study is to compare the feeding practices of ETIs and FTIs living in New Zealand during the first six months after birth in relation to recommendations, and determine the factors that influence their feeding practices.

Methods: Participants were eligible for inclusion into the study if they were born ≥ 37 weeks gestation and were aged between five and nine months at the time of recruitment. A total of 438 infants and their caregivers were recruited from across New Zealand. An online six month infant feeding questionnaire was administered which collected data on feeding in the first week after birth; feeding from two weeks to six months; current intake; problems with feeding; obstetric and demographic details.

Results: Early term infants were less likely to exclusively breastfeed during their hospital stay ($P=.013$), at week one ($P=.016$), week four ($P=.029$), week 17 ($P=.040$) and week 22 ($P=.014$) compared to FTIs. No differences were seen between the two groups at 26 weeks of age. Mothers of ETIs reported experiencing more breastfeeding difficulties during the first week after birth compared to FTIs ($P=.015$). Early term infants were more

likely to be born by elective caesarean birth ($P=.003$) compared to FTIs. More ETIs were born to mother's ≥ 35 years of age compared to FTIs (41.1% versus 33%). Infants born early term were more likely to be admitted under paediatric care ($P=.003$) and be admitted to a newborn care unit ($P=.007$) after birth compared to FTIs. The median (IQR) age of the introduction to solid foods was 22.8 (20.4-25.4) weeks, no differences were seen in the timing of the introduction of complementary foods between ETIs and FTIs. The most common first foods introduced to infants were vegetables (34.8%), followed by infant baby rice or cereal (33.0%) and fruit (20.0%), no infants were introduced to red meat as their first food.

Conclusion: Differences in infant feeding practices and health outcomes were identified between ETIs and FTIs. It is suggested that District Health Boards, health care professionals, and stakeholders in New Zealand adopt the definition of early term birth.

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Table of Contents

Abstract	i
Acknowledgement	iii
Abbreviations	ix
1.0. Introduction	1
1.1. Background.....	1
1.2. Statement of the problem.....	5
1.3. Study purpose.....	5
1.3.1. <i>Significance of this research</i>	5
1.3.2. <i>Aim</i>	5
1.3.3. <i>Objectives</i>	6
1.3.4. <i>Hypothesis</i>	6
1.4. Thesis structure	6
1.5. Research contributors	7
2.0. Literature Review	8
2.0.1. <i>Literature review objective</i>	8
2.0.2. <i>Search criteria</i>	8
2.1. Term birth	9
2.1.1. <i>Defining term birth</i>	9
2.1.2. <i>Prevalence of early term births</i>	10
2.1.3. <i>Causes of early term births</i>	10
2.1.4. <i>Consequences of early term birth</i>	11
2.2. Nutritional considerations for early term infants.....	14
2.2.1. <i>Infant energy and protein requirements</i>	15
2.2.2. <i>Iron requirements during infancy</i>	15
2.2.3. <i>Requirements for calcium and vitamin D during infancy</i>	16
2.3. Breastfeeding.....	17
2.3.2. <i>Exclusive breastfeeding</i>	18

2.3.3. Breastfeeding recommendations	19
2.3.5. Factors influencing the initiation and duration of breastfeeding	22
2.3.6. Health benefits of human breastmilk.....	24
2.3.7. Artificial infant feeding	25
2.3.8. Contraindication to exclusive breastfeeding.....	26
2.3.9. Current infant feeding practices from birth until six months of age.....	26
2.4. Complementary feeding	30
2.4.1. Defining complementary feeding.....	30
2.4.2. Physiological aspect of complementary feeding.....	30
2.4.3. Nutritional aspect of complementary feeding	31
2.4.4. Recommendations for the introduction of complementary foods	32
2.4.7. Complementary feeding guidelines for infants.....	33
2.4.8. Factors which influence current feeding practices	34
2.4.9. Current complementary feeding practices.....	35
2.5. Summary	37
3.0. Methods	38
3.1. Study design.....	38
3.2. Ethical approval.....	38
3.3. Study setting	38
3.4. Study population	38
3.5. Data collection	41
3.6. Statistical analysis.....	43
4.0. Results	44
4.1. Description of participants	44
4.2. Milk feeding practices	47
4.3. Complementary feeding practices of infants	53
5.0. Discussion	61
5.1. Maternal and obstetric characteristics.....	62
5.2. Milk feeding practices	64
5.3. Complementary feeding practices	68

6.0. Conclusion	73
6.1. Summary.....	73
6.2. Conclusion.....	74
6.3. Strengths	75
6.4. Limitations	77
6.5. Recommendations for further research	79
References.....	80
Appendices.....	90
Appendix A: Steps to successful breastfeeding.....	90
Appendix B: HDEC study approval letter.....	91
Appendix C: HDEC revised study application approval letter.....	93
Appendix D: Auckland City Hospital study approved document	94
Appendix E: Letter of invite (phase one).....	95
Appendix F: Information sheet.....	96
Appendix G: Consent form (phase one).....	100
Appendix H: Contact details form (phase one)	101
Appendix I: Study brochure	102
Appendix J: Letter to Reach Me	104
Appendix K: Six month infant feeding questionnaire	105
Appendix L: Medical notes data collection sheet (phase one).....	125

List of Tables

Table 1: Neonatal and infant mortality for singleton birth 34 to 41 weeks of gestation in a 2001 cohort from the United States (table adapted from Reddy et al. (2009)	13
Table 2: New Zealand Ministry of Health breastfeeding definitions	19
Table 3: Exclusive breastfeeding rates in developed countries	27
Table 4: Breastfeeding duration from birth until six months of age.....	29
Table 5: Studies looking at the age complementary foods are introduced to infants in developed countries.....	36
Table 6: Baseline characteristics of infants, and their mothers.....	46
Table 7: Milk feeding during the first week.....	47
Table 8: Mode of feeding in the first week after birth.....	48
Table 9: Factors influencing the introduction of infant formula in the 1st week after birth	48
Table 10: Feeding issues form birth until 6 months of age.....	50
Table 11: Mother and infant feeding issues from after hospital discharge.....	51
Table 12: Factors influencing breastfeeding cessation from two weeks to six months of age.....	52
Table 13: Age complementary feeding commenced.....	53
Table 14: First foods introduced to infants	54
Table 15: Foods introduced in the first two weeks after complementary feeding commenced.....	55
Table 16: Infant feeding styles	56
Table 17: Foods introduced to infants after 6 months of age.....	57
Table 18: Factors influencing the introduction of complementary foods	59
Table 19: Developmental cues used to determine readiness for complementary foods	59

List of Figures

Figure 1: <i>Gestational age designations for term infants (figure adapted from National Child and Maternal Health Education Program, 2014)</i>	9
Figure 2: <i>Profile of participants in the study</i>	44
Figure 3: <i>Exclusive breastfeeding rates of ETIs and FTIs</i>	49
Figure 4: <i>Milk feeding from week one until six months</i>	50

Abbreviations

Abbreviation	Terminology
ACH	Auckland City Hospital
BLW	Baby led weaning
BMI	Body Mass Index
CI	Confidence Interval
DHB	District Health Boards
ESPGHEN	European Society for Paediatric Gastroenterology Hepatology and Nutrition
ETIs	Early Term Infants
FTIs	Full Term Infants
GA	Gestational Age
GUINZ	Growing Up in New Zealand
HDEC	Health Disability Ethics Committee
ID	Iron deficiency
IDA	Iron deficiency anaemia
NICU	Newborn intensive care unit
RDI	Recommended dietary intake
RR	Relative Risk
WHO	World Health Organisation
UNICEF	United Nations Children's Fund

1.0. Introduction

1.1. Background

The World Health Organisation (WHO) and the Ministry of Health (2015b) defines term infants as those infants born between 37 weeks 0 days to 41 weeks 6 days gestation. It is believed these infants do not experience increased risks associated with their birth (Reddy et al., 2011; WHO, 2011), however there is growing evidence to the contrary. Evidence is beginning to show that infants born between 37 weeks and 0 days to 38 weeks and 6 days have higher mortality and are at increased risk of short- and long-term morbidities compared to those born greater than 39 weeks 0 days gestation (Craighead & Elswick, 2014; Dong, Chen, & Yu, 2012; Morrison, Rennie, & Milton, 1995). Short-term risks include increased admission to the Newborn Intensive Care Unit (NICU) and increased risk of respiratory distress syndrome (Brown, Speechley, Macnab, Natale, & Campbell, 2014; Craighead & Elswick, 2014; Morrison et al., 1995; Wilmink et al., 2010). Currently these infants are the fastest growing subgroup of newborns and as a result they have been recently defined as early term infants (ETIs) (Dong et al., 2012).

In recent years, there has been a considerable increase in the number of planned births occurring between 37 weeks 0 days to 38 weeks 6 days gestation (Dong et al., 2012; Marin, Oshiro, Chagolla, Bingham, & Kowalewski, 2009). The reasons behind the substantial rise in infants born during this gestational period is unclear; however, it is hypothesised that this rise is predominately due to an increase in preventable and unnecessary elective inductions and caesarean births (Craighead, 2012; Engle & Kominiarek, 2008). A review by Engle and Kominiarek (2008) established that 17.5% of all live births in the United States of America are at early term. In New Zealand there are currently few published data available on the number of ETIs born annually. A large longitudinal study, Growing Up in New Zealand (GUiNZ), investigated the difference in gestational age at birth of 6846 infants (6662 singletons and 184 triplets or twins). The study found that approximately 22.1% of infants born between the 25th of April 2009 and the 25th of March 2010 were born at early term (Morton et al., 2012). This study included European, Māori, Pacific, Asian and other ethnic groups, representing New

Zealand's cultural diversity. The New Zealand Ministry of Health (2015b) has recently reported on the number of ETIs born annually. The report states that between 2005 and 2014 there has been a significant increase in the number of infants born at 37, 38, and 39 weeks gestation, whilst the number of infants born at 40 and 41 weeks has seen a significant decrease.

Globally there has been a noticeable increase in the number of elective inductions and caesarean births along with an increase in the number of infants born before 39 weeks gestation (Menacker & Hamilton, 2010; Morris et al., 2012; National Maternity Monitoring Group, 2014). A recent report by the National Maternity Monitoring Group (2014) has determined that there are significant variations in the rates of elective caesareans and inductions of labour between 37 weeks and less than 40 weeks gestation at District Health Boards (DHBs) across New Zealand. In 2012 the majority of inductions of labour carried out at various DHBs across the country occurred between 37 and 38 weeks gestation, whilst a much smaller number were carried out at 39 weeks'. The majority of DHBs experienced similar elective caesarean birth rates across 37, 38, and 39 weeks gestation. However, at a number of DHBs the rate of elective caesarean births was greatest at 37 and 38 weeks' gestation compared to 39 weeks (National Maternity Monitoring Group, 2014).

Evidence is also emerging that ETIs are at increased risk of suboptimal feeding practices. Observational studies have shown ETIs are less likely to initiate breastfeeding and are likely to breastfeed for a shorter duration when compared to infants born greater than 39 weeks' gestation (Craighead & Elswick, 2014; Donath & Amir, 2008; Lutsiv et al., 2013). Infant feeding practices consisting of both exclusive breastfeeding and the introduction of appropriate complementary foods at a suitable time are some of the most effective methods of ensuring optimal nutritional status and infant survival (Kramer & Kakuma, 2012). Early term infants may be at increased risk of suboptimal feeding practices, as they are more likely to have feeding difficulties due to oro-motor immaturity and the presence of neonatal complications such as respiratory distress syndrome (Craighead, 2012; Donath & Amir, 2008). Consequently this subgroup of neonates could be at increased

risk of suboptimal feeding, which may have negative effects on short- and long-term health.

Given the importance of nutrition for healthy infant development, suboptimal breastfeeding and complementary feeding practices during infancy can have significant health effects (WHO, 2001), such as malnutrition (WHO, 2001), faltering growth (Norris, Larkin, Williams, Hampton, & Morgan, 2002b), nutritional deficiencies, including zinc, protein and iron (Norris et al., 2002b), reduced immunity (Andersson et al., 2009), gastrointestinal infections (Beaudry, Dufour, & Marcoux, 1995) and poorer neuro-developmental outcomes (Aggett et al., 2006; Lindstrom, Lindblad, & Hjern, 2011).

Prior to 2001, the WHO recommended that infants should be exclusively breastfed for four to six months however after a systematic review by authors Kramer and Kakuma (2002) this recommendation was changed to infants should be exclusively breastfed for the first six months (WHO, 2002a). Kramer and Kakuma (2002) looked at the benefits of exclusive breastfeeding for six months versus three to four months. The review included 16 studies, seven of which involved developing countries. Of the 16 studies included just two were randomised trials both of which were from Honduras. The authors concluded that there was no apparent risk to exclusive breastfeeding for the first six months as a general policy for infants in both developed and developing countries. However one of the randomised controlled trials found that infants who delayed the introduction of solids until six months had a lower iron status compared to those who began solids at four months. New Zealand, like many other developed countries adopted this recommendation and currently recommends infants be exclusively breastfed for around six months of age (Ministry of Health, 2008a).

The introduction of complementary foods is recommended at around six months as it is at this age that breastmilk alone is unable to meet the nutritional needs of growing infants (WHO, 2001). The introduction of complementary foods is a vulnerable time for infants as it is during this period that major changes to both macro- and micro-nutrient consumption occur (ESPGHAN Committee on Nutrition, 2008). In many countries this is associated with a rise in the rate of malnutrition, faltering growth and nutritional

deficiencies such as iron. Furthermore, any nutritional deficiencies obtained during this period tend to persist into later childhood (WHO, 2001). It is suggested suitable first foods be nutrient-dense, contain appropriate amounts of iron, protein and energy to ensure growth and development is maintained (Butte, Lopes-Alarcon, & Garza, 2002).

Evidence suggests infants in many countries, including New Zealand, are not being fed according to current recommendations. In numerous developed countries, many infants are exclusively breastfed for less than six months and complementary foods are often introduced before six months of age (Australian Institute of Health & Welfare, 2012; Giovannini et al., 2004; Grummer-Strawn, Scanlon, & Fein, 2008; McAndrews et al., 2012). Data from Plunket New Zealand (2015) reveals exclusive breastfeeding rates over the past seven years (2008-2014) have remained somewhat constant. At six weeks of age 53% to 55% of New Zealand infants are exclusively breastfed; however by six months only 16% to 17% are exclusively breastfed. The GUiNZ study has shown that the mean length of breastfeeding by New Zealand mothers is approximately 4.4 months (Morton et al., 2012). Similar findings have been reported in other developed countries (Andrén Aronsson et al., 2013; Scott, Binns, Graham, & Oddy, 2009).

Several factors have been identified which may influence mothers' decisions to initiate and continue breastfeeding, including maternity leave (Hawkins, Griffiths, Dezateux, & Law, 2007), socioeconomic status, maternal age, marital status, education level, maternal smoking, preterm birth (Thulier & Mercer, 2009), pre-labour caesarean deliveries (Prior et al., 2012) and maternal body mass index (BMI) (Forster, McLachlan, & Lumley, 2006). As ETIs may be at risk of encountering problems with breastfeeding due to immature oral motor skills this too could be an influencing factor on breastfeeding duration. If women experience breastfeeding problems during the early postpartum period they are at increased risk of breastfeeding cessation (Dewey, Nommsen-Rivers, Heinig, & Cohen, 2003; Gerd, Bergman, Dahlgren, Roswall, & Alm, 2012). The reasons as to why breastfeeding is unsuccessful, why women discontinue breastfeeding early and motives for introducing complementary foods are important to understand, as this knowledge is necessary for the development of strategies to promote optimal infant feeding.

1.2. Statement of the problem

To date, a small number of studies have investigated the breastfeeding practices of ETIs however none have examined the introduction of complementary foods in this population group. There is also limited national research available documenting the factors that influence infant feeding practices following early term birth. Therefore, this will be the first exploratory study in New Zealand to determine if there are any differences in feeding practices between ETIs and FTIs. This observational study has been designed to provide insight into all types of nutrition (milk, solids and other fluids) and infant feeding practices in ETIs and FTIs. It will also examine the factors influencing these practices. This present study will report findings on infant feeding practices from birth until six months of age.

1.3. Study purpose

The purpose of this thesis is to compare the feeding practices of ETIs and FTIs living in New Zealand during the first six months after birth in relation to national infant feeding recommendations, and to determine the factors that influence these feeding practices.

1.3.1. Significance of this research

The findings from this study may help guide future public health infant feeding policies and initiatives, as it will identify whether infant feeding practices in New Zealand are optimal and whether early term birth influences these feeding practices. If a significant number of ETIs or FTIs are found to have suboptimal feeding practices and specific contributory factors are identified, then strategies to address these issues will need to be examined in order to lessen the risk of short- and long-term suboptimal health outcomes.

1.3.2. Aim

To compare the feeding practices of ETIs and FTIs living in New Zealand during the first six months after birth in relation to recommendations, and the factors that influence their feeding practices.

1.3.3. Objectives

1. Compare the feeding practices of ETIs and FTIs from birth until six months of age.
2. To explore the feeding practices of ETIs and FTIs during the first week after birth.
3. Describe feeding practices of ETIs and FTIs from birth until six months of age in relation to national infant feeding guidelines.
4. Identify factors that may influence the feeding practices of ETIs and FTIs.

1.3.4. Hypothesis

1. Early term infants will experience suboptimal feeding practices compared to FTIs over the first six months after birth.
2. Early term infants will experience lower exclusive breastfeeding rates compared to FTIs during the first week after birth.
3. Infants are not being fed inline with current national infant feeding guidelines.

1.4. Thesis structure

This thesis is divided into the following chapters:

Chapter 1, Introduction: This chapter sets the scene and contextualises the study and highlights its importance. Chapter 2, Literature review: This chapter provides a comprehensive literature review, focusing on definitions of ETIs, comparing infant feeding practices between ETIs and FTIs, looks at the factors that contribute to feeding practices and details the consequences of suboptimal feeding practices. Chapter 3, Methods: This chapter provides an in depth description of the materials and methods used throughout the research study. Chapter 4, Results: This chapter reports on the findings from the research. Chapter 5, Discussion: This chapter presents a detailed discussion of the research findings. Chapter 6, Conclusion: This chapter offers conclusions regarding the research, reflects on the studies strengths and limitations and provides recommendations for future research.

1.5. Research contributors

Author	Contributions to Thesis
Victoria Arliss	Led the research, development of the questionnaires, research documents, recruited participants, acquired the data, performed the statistical analysis and interpretation of the data, main author of thesis.
Dr Cath Conlon	Academic supervisor, conception and design of the study, assisted with the development of the questionnaire, applied for ethical approval, aided in the recruitment of participants, revised and approved the final thesis.
Barbara Cormack	Professional supervisor, conception and design of the study, assisted with locality approval, advised on clinical aspects of infant feeding, revised and approved the final thesis.
Dr Chris McKinley	Professional supervisor, conception and design of the study, assisted with the development of the questionnaire and research design, assisted with locality approval, provided assistance with statistical analysis, reviewed and approved the final thesis.
Owen Mugridge	Assisted with the administration of the questionnaire.

2.0. Literature Review

2.0.1. Literature review objective

The primary objective of this literature review was to review the evidence available on early term and full term infant feeding practices from birth until six months. It reviews the definition of early term birth, its prevalence, and health implications. It will then go on to discuss infant feeding for optimal health outcomes, starting with nutritional considerations for infants, followed by breastfeeding and then complementary feeding. Factors influencing breastfeeding and complementary feeding practices are also discussed in these sections. A summary of the findings from the literature is provided at the end of the review.

2.0.2. Search criteria

Studies included in this review were dated from 1951 to 2015, although the majority were published after 2000. Studies were obtained using the following electronic databases: PUBMED; Google Scholar; Web of Science; and The Cochrane Library. Key recommendations from organisations such as the World Health Organisation, New Zealand Ministry of Health, European Society for Paediatric Gastroenterology Hepatology and Nutrition (ESPGHAN) guidelines, American College of Obstetricians and Gynecologists, National Maternity Monitoring Group, United Nations Children's Fund (UNICEF) and The Royal Australian and New Zealand College of Obstetricians and Gynaecologists have also been included in this review.

2.0.3. Key search terms

Early term infants, caesarean section delivery, inductions of labour, definition, breastfeeding, breastfeeding benefits, breastfeeding initiation, human breastmilk, human milk composition, artificial feeding, infant formula, complementary food, complementary feeding, baby-led weaning, infant nutrition, infant feeding, guidelines, protein, energy, iron deficiency, iron, iron supplementation, vitamin D deficiency, vitamin D supplementation, mortality, morbidity, meta-analysis, systematic review, New Zealand and enteral feeds.

2.1. Term birth

2.1.1. Defining term birth

Term infants have traditionally been defined as those born 37 weeks 0 days to 41 weeks 6 days gestation (259-293 days from the last menstrual period) (Fleischman, Oinuma, & Clark, 2010; WHO, 2011). They are often considered healthy and treated as a homogenous group of neonates who, when compared to preterm (less than 37 weeks gestation) and post-term (greater than 42 weeks gestation) infants, do not have increased risks associated with their gestational age at birth (Reddy et al., 2011; WHO, 2011). However, those infants born between 37 weeks 0 days to 38 weeks 6 days gestation appear to be at increased risk of mortality and short- and long-term morbidities, compared to those born between 39 to 41 weeks gestation (Engle & Kominiarek, 2008; Machado, Passini, Rosa, & Carvalho, 2014; Reddy et al., 2011). There is also evidence to suggest that lung, liver, brain growth and development is significant between 37 weeks 0 days to 38 weeks 6 days gestation (American College of Obstetricians and Gynecologists, 2013). As a result in November 2013 the American College of Obstetricians and Gynecologists and the Society for Maternal Fetal Medicine committee suggested that the word "term" be discouraged since risks vary by gestation even after 36 weeks (Spong, 2013). It has also been recommended that the period classified as "term" be subdivided into three categories — early term (births occurring between 37 weeks 0 days to 38 weeks 6 days), full term (births occurring between 39 weeks 0 days to 40 weeks 6 days), late term (births occurring between 41 weeks 0 days to 41 weeks 6 days) and post term 42 weeks and beyond (**Figure 1**) (Spong, 2013).

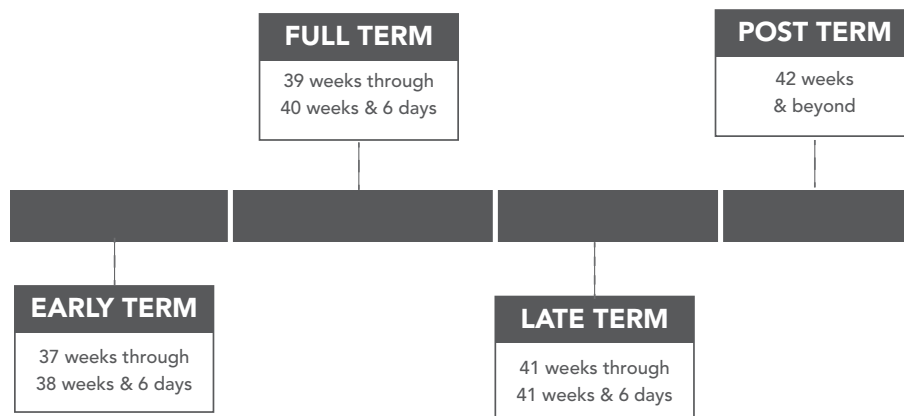


Figure 1: Gestational age designations for term infants (figure adapted from National Child and Maternal Health Education Program, 2014)

2.1.2. Prevalence of early term births

In recent years, births occurring between 37 weeks 0 days to 38 weeks 6 days gestation have increased considerably (Dong et al., 2012; Marin et al., 2009). A review by Engle and Kominiarek (2008) established that 17.5% of all live births in the United States of America are at early term. The New Zealand Ministry of Health (2015b) currently regards term infants as those born at 37 weeks gestation to 41 completed weeks of gestation. The New Zealand Ministry of Health (2015b) has recently reported on the number of early term infants (ETIs) born annually. The report found that between 2005 and 2014 there was a significant increase in the number of infants born at 37, 38, and 39 weeks gestation, whilst the number of infants born at 40 and 41 weeks was significantly decreasing (Ministry of Health, 2015b, Figure 53: Percentage of babies, by gestation in weeks, 2005–2014, p.57). Organisations such as the National Maternity Monitoring Group (2014) are also beginning to monitor these births. Recently, the group produced a report examining the variations in the rates of elective caesarean births and induction of labour between 37 weeks 0 days to 38 weeks 6 days gestation at District Health Boards (DHBs) across New Zealand. The report found that in 2012 the majority of inductions of labour and elective caesarean births carried out at various DHBs across the country were conducted between 37 weeks 0 days to 38 weeks 6 days gestation (National Maternity Monitoring Group, 2014).

2.1.3. Causes of early term births

The reasons behind the substantial rise in early term births are unclear. However, it is hypothesised that this increase is predominately due to an increase in preventable and unnecessary elective inductions and caesarean births (Engle & Kominiarek, 2008). Worldwide and national research has shown that there has been a noticeable increase in the number of elective inductions and caesareans, along with an increase in the number of infants born before 39 weeks gestation (Menacker & Hamilton, 2010; Morris et al., 2012; National Maternity Monitoring Group, 2014).

2.1.3.1. International recommendations for elective caesarean delivery

The Royal Australian and New Zealand College of Obstetricians and Gynaecologists along with other international obstetric bodies such as The American College of Obstetricians and Gynecologists (2013) recommend that elective deliveries of uncomplicated low risk singleton pregnancies should not be performed before 39 weeks' gestation due to increased risk of morbidities (The American College of Obstetricians and Gynecologists, 2013). The WHO (2012) also supports this recommendation. In the event of a high risk pregnancy (pre-eclampsia, multiple pregnancies, placenta previa or fetal complications) early elective caesarean delivery may be required, particularly if the risks associated with the pregnancy outweigh those of early delivery (Royal Australian and New Zealand College of Obstetricians and Gynaecologists, 2014).

2.1.3.2. Factors contributing to the increase in elective deliveries

Potential factors contributing to the increase in elective inductions and caesarean births prior to 39 weeks gestation include: maternal demographic characteristics (e.g. older maternal age) (Menacker & Hamilton, 2010), maternal choice (Menacker & Hamilton, 2010), obstetricians practice patterns (Engle & Kominiarek, 2008; Menacker & Hamilton, 2010; Pot & Sadler, 2013), reductions in vaginal births after caesarean deliveries (National Maternity Monitoring Group, 2014; Pot & Sadler, 2013), increased observation and medical interventions such as preventing stillbirths (Engle & Kominiarek, 2008; Menacker & Hamilton, 2010) and a maternal BMI of 25kg/m² or more (Dodd, Grivell, Nguyen, Chan, & Robinson, 2011)

2.1.4. Consequences of early term birth

2.1.4.1. Short- and long-term risks of morbidity

Infants born electively before 39 weeks gestation are at increased risk of both short- and long-term morbidities. An abundance of evidence has been gathered regarding the short-term outcomes of early term births. In the mid-nineties Morrison et al. (1995) established that the timing of caesarean delivery influenced the respiratory outcomes of infants. They found that the risk of respiratory distress syndrome was increased if caesarean birth occurred before 39 weeks gestation. Others retrospective studies have

also confirmed this finding (Tita et al., 2009; Zanardo et al., 2004). Early term infants also experience more NICU admissions than those born greater than 39 weeks gestation (Brown et al., 2014; Craighead & Elswick, 2014; Wilmink et al., 2010). In addition, ETIs are at increased risk of suboptimal feeding practices, as they tend to be developmentally immature compared to those born greater than 39 weeks gestation. Developmental immaturity, for instance, poor lung function and under developed oral-motor skills, hinder their ability to feed in a manner that meets their physiological needs (Craighead, 2012; Donath & Amir, 2008). Consequently they are at increased risk of the negative health outcomes associated with suboptimal feeding practices.

While the short-term outcomes associated with early term births have been well documented, less is known about the long-term health outcomes for this subgroup of newborns. Emerging evidence suggest ETIs may be at increased risk of cerebral palsy (Moster, Wilcox, Vollset, Markestad, & Lie, 2010), subtle developmental impairments, for example, mathematical difficulties (Dong et al., 2012), and behavioural and emotional problems like Attention Deficit Hyperactivity Disorder (Lindstrom et al., 2011). The underlying mechanisms of these effects are largely unknown (Dong et al., 2012). Future studies are required to fully assess the risks of adverse long-term outcomes. Currently there is insufficient evidence to make conclusive statements regarding the long-term health outcomes of infants born early term.

2.1.4.2. Mortality risk

Numerous American studies have found infants born at 34 to 36 weeks' gestation, often known as "late preterm infants," have a three times higher risk of mortality than term infants (King, Gazmararian, & Shapiro-Mendoza, 2014). Although considered term, ETIs also have a greater risk of infant mortality compared to those born full term (**Table 1**) (Engle, 2011; Reddy, Ko, Raju, & Willinger, 2009). Because of this increased risk, researchers are now beginning to assess the risk of mortality amongst ETIs in greater detail. A Swedish longitudinal cohort study involving 679,981 singleton infants born between 1973 to 1979, found that when ETIs were compared to infant's born greater than 39 weeks gestation they were at increased risk of mortality during the neonatal and postnatal period as well as during young adulthood but not in late

childhood/adolescence. In young adulthood their risk of mortality was particularly associated with congenital anomalies mainly due to cardiovascular malformations and endocrine disorders such as diabetes (Crump, Sundquist, Winkleby, & Sundquist, 2013). A retrospective study by King et al. (2014) analysed data of 874,532 late preterm and 3,164,489 ETIs from the National Centre for Health Statistics from 2003 to 2005 with the aim of identifying disparities in infant mortality rates amongst United States infants born late preterm or early term by race/ethnicity, maternal age and multiple births. The researchers found that the leading causes of death among ETIs in all categories were congenital abnormalities, sudden infant death syndrome, and accidents however it is unknown whether these are of significance, as this was not reported. The researchers also did not investigate whether these causes of death differed from full term infants (FTIs). Another retrospective study by Reddy et al. (2011) examined 46,329,018 singleton live births, using data from the National Centre for Health Statistics U.S. from 1995 to 2006. Similarly the authors found the leading causes of death amongst ETIs were congenital abnormalities, sudden infant death syndrome, and accidents.

It would appear more education is required to prevent the number of infant deaths by infant death syndrome and accidents. Additionally, preconception and pregnancy healthcare education such as dietary and lifestyle advice may be important in reducing the number of infants born with congenital abnormalities (King et al., 2014).

Table 1: Neonatal and infant mortality for singleton birth 34 to 41 weeks of gestation in a 2001 cohort from the United States (table adapted from Reddy et al. (2009))

GA, wk	Neonatal Mortality		Infant Mortality	
	Rate per 1000 live births	RR (95% CI)	Rate per 1000 live births	RR (95% CI)
34	7.1	9.5 (8.4–10.8)*	11.8	5.4 (4.9–5.9)*
35	4.8	6.4 (5.6–7.2)*	8.6	3.9 (3.6–4.3)*
36	2.8	3.7 (3.3–4.2)*	5.7	2.6 (2.4–2.8)*
37	1.7	2.3 (2.1–2.6)*	4.1	1.9 (1.8–2.0)*
38	1.0	1.4 (1.3–1.5)*	2.7	1.2 (1.2–1.3)*
39	0.8	1.00 (reference)	2.2	1.00 (reference)
40	0.8	1.0 (0.9–1.1)	2.1	0.9 (0.9–1.0)
41	0.8	1.1 (0.9–1.2)	2.2	1.1 (1.0–1.1)

*P <0.001 for comparison with infants born at 39 weeks gestation.

2.1.4.3. Implications of redefining term births

In 2009 the 'Hard-Stop' policy to prevent elective deliveries prior to 39 weeks gestation was implemented at Summa Akron City Hospital, Ohio, United States. After the implementation of the policy the hospital conducted a retrospective study of 18,503 women looking at the birth rates of macrosomic infants, the number of stillbirths, admissions to NICU, as well as term singleton deliveries before and after the implementation of the policy. They found significant decreases in stillbirths and a decrease in the rates of admission to NICU, however found no significant difference in the birth rate of macrosomic infants (ACOG, 2013). In the United States, in 2010 approximately 17% of newborns were delivered before 39 weeks gestation. By redefining term births, in 2013 4.6% of newborns were delivered before 39 weeks gestation (CMAJ, 2014). By redefining the definition of term births, the number of inductions and caesarean births before 39 weeks gestation may reduce newborn infants' risk of developing short or long-term health complications.

2.2. Nutritional considerations for early term infants

The first 1,000 days of life, the period from conception through to 24 months of age, provides a crucial window of opportunity to shape the health, development and overall wellbeing of individuals (Bryce, Coitinho, Darnton-Hill, Pelletier, & Pinstруп-Andersen, 2008). Nutrition during this time has profound biological effects, as it significantly influences children's physical development, cognitive ability, as well as short- and long-term health outcomes (Black et al., 2008; Bryce et al., 2008; ESPGHAN Committee on Nutrition, 2008).

During pregnancy the last trimester is a crucial period for the growing fetus, as it is during this time that the fetus actively transfers and accumulates its nutrient stores and rapid growth, organ maturation and development takes place (Palmer & Makrides, 2012). As a result, gestational age influences infants' nutrient stores. To date there are substantial gaps in the literature regarding ETIs nutritional requirements. Currently there

is no published data available on their nutritional stores at birth or their nutritional requirements during infancy. Consequently it is unknown whether ETIs have similar nutrient stores and requirements to FTIs or whether their needs are closer to that of infants born late preterm. Due to the lack of data available infants born early term will be regarded as term infants in this review.

2.2.1. Infant energy and protein requirements

At birth energy and protein requirements are determined by a number of factors such as gestational age, body size, clinical condition, body composition and resting energy expenditure (Agostoni et al., 2010). During the neonatal period, healthy term infants require approximately 1800kJ (female) or 2000kJ (male) of energy and 10g (1.43g/kg/d) of protein per day to provide adequate nutrients to meet physiological needs and sustain optimal growth and development (Ministry of Health, 2008a; NHMRC, 2006). Infants are vulnerable to changes in nutritional intake; consequently reductions in energy intake can be detrimental to infants' development, resulting in faltering growth (Norris, Larkin, Williams, Hampton, & Morgan, 2002a), malnutrition (WHO, 2014) and can affect neurodevelopment (Agostoni et al., 2010).

2.2.2. Iron requirements during infancy

The fetus lays down iron stores during the last trimester of pregnancy (Widdowson & Spray, 1951). Healthy full term breastfed infants whose mothers had good iron stores during pregnancy are likely to have sufficient stores until they are approximately four to six months of age (Domellof et al., 2014). In breastmilk iron is present in low concentrations however is highly bioavailable making it a suitable source of iron for most healthy term infants during this time (Ministry of Health, 2008a).

If infants miss some or all of the last trimester of pregnancy they are likely to be born with reduced iron stores (Widdowson & Spray, 1951). Infants born with reduced stores at birth are at increased risk of iron deficiency (ID) and iron deficiency anaemia (IDA) during a critical window of development (Berglund, Westrup, & Domellöf, 2010). Observational studies have demonstrated the associations between IDA and suboptimal

neurodevelopment (Lozoff et al., 2006). Those at increased risk of ID and IDA are low birth weight infants (infants born less than 2500g), which includes term, small for gestational age infants and preterm infants (Cormack, 2014; Domellof et al., 2014). Consequently low birth weight infants may require supplementation during infancy in order to meet physiological requirements for growth and development (Domellof et al., 2014).

2.2.2.1. Current recommendation for iron supplementation

The ESPGHEN Committee on Nutrition have concluded that low birth weight infants (less than 2500g) should receive a daily iron supplement at a dose of 2–3mg/kg of elemental iron starting at two to six weeks of age. These guidelines also recommend infants continue iron supplementation until at least six to twelve months of age depending on their dietary intake (Agostoni et al., 2010). Currently there are no published studies examining ETIs iron status during the neonatal period or infancy.

2.2.3. Requirements for calcium and vitamin D during infancy

Vitamin D is an essential nutrient for maintaining bone health, immunity, and muscle function. It may also have a role in preventing some cancers (Holick & Chen, 2008). Synthesised in the skin by exposure to sunlight or obtained from the diet, its primary function is to regulate calcium and phosphate metabolism as well as support neuromuscular function (Agostoni et al., 2010). Inadequate Vitamin D intake during infancy can significantly affect calcium homeostasis. Calcium is an important micronutrient, as it is vital for bone development, muscle contractions, blood clotting, transmitting nerve impulses and is also involved in the activation of a number of enzymes (Ministry of Health, 2008a). Children who are deficient in vitamin D are at risk of developing rickets and osteomalacia (Braegger et al., 2013).

Vitamin D accrual takes place throughout pregnancy, primarily during the last trimester and is dependent on maternal vitamin D stores during pregnancy (Bowyer et al., 2009). Breastmilk is a poor source of vitamin D compared to infant formula as formulas are often fortified with vitamin D (Paxton et al., 2013). Those born preterm, to mothers with low

vitamin D status, experience a lack of sun exposure, and who are breastfed are at increased risk of being born with or developing vitamin D deficiency (Agostoni et al., 2010; Paxton et al., 2013).

2.2.3.1. Current recommendation for vitamin D supplementation

The American Academy of Paediatrics reviewed the literature regarding vitamin D supplementation during infancy, childhood, and adolescence. From their review they recommend breastfed and partially breastfed infants should be supplemented with 400IU/day of vitamin D beginning in the first few days after birth. This supplementation should continue unless infants are transitioned onto vitamin D fortified infant formula or until cow's milk becomes part of their diet at around one year of age. The authors also recommend non-breastfed infants who are consuming less than 1000ml/day of vitamin D fortified formula or milk should also be supplemented with 400IU/day (Wagner & Greer, 2008).

According to the New Zealand Ministry of Health (2012) evidence does not support vitamin D supplementation for healthy breastfed infants in New Zealand. However it does recommend children at risk of vitamin D deficiency (preterm, born to vitamin D deficient mothers, are not regularly exposed to sunlight, or have dark pigmented skin) may benefit from routine supplementation. In a position statement by Paxton et al. (2013) they recommend infants in New Zealand at risk of vitamin D deficiency receive a 400IU vitamin D supplement daily for at least the first year after birth.

2.3. Breastfeeding

Optimal feeding practices during the first six months after birth are vitally important for the short- and long-term health outcomes of infants. Internationally, human breastmilk is recognised as the ideal first food for infants (WHO, 2002b). Human breastmilk is a dynamic multi-faceted fluid, containing numerous bioactive molecules and functional components which protect against infections, inflammation, contribute to the maturation of the immune system and promote growth (Ballard & Morrow, 2013; Ministry of Health, 2008a). Human breastmilk also contains the necessary nutrients required to promote

healthy physical, neurological and emotional development (Ballard & Morrow, 2013; Ministry of Health, 2008a).

2.3.1. Composition of human breastmilk

The composition of human breastmilk is dependent upon a variety of factors, including: time after delivery, gestation, length of lactation and method of expression and collection (Tudehope, 2013). During the first 24 to 48 hours after delivery the first milk produced is colostrum, rich in immunological components and growth factors (Ballard & Morrow, 2013). By day five, transitional milk (similar in characteristics to colostrum but is a period of increased milk production, which is necessary to support the needs of rapidly growing infants) typically replaces colostrum. Transitional milk lasts for approximately two weeks and is rich in fat, lactose, and vitamins. Near the end of the first two weeks mature milk begins to appear. The nutrient density of mature milk is lower than that of transitional milk and is less concentrated. Once matured, the composition of human breastmilk remains relatively stable with subtle changes occurring from day-to-day and within feeds (Ballard & Morrow, 2013; Tudehope, 2013).

2.3.2. Exclusive breastfeeding

The definition of exclusive breastfeeding is that, to the mother's knowledge only breastmilk from the breast or expressed breastmilk and prescribed medicines (as per the Medicines Act 1981) have been given to her infant from birth and the infant has consumed no solid food or other fluids, not even water (breastfeeding terms are defined in **Table 2**) (Ministry of Health, 1999). Exclusive breastfeeding provides all the necessary nutrition and fluid infants require during their first six months after birth (Ministry of Health, 2008a). The WHO and UNICEF (2003) has also produced a hierarchy for infant feeding which is as follows:

1. Breastfeeding from the infant's mother;
2. Expressed breastmilk from the infant's mother;
3. Breastmilk from another woman (donor milk);
4. Artificial feeding with powdered infant formula.

Table 2: *New Zealand Ministry of Health breastfeeding definitions*

Category	Definition
Exclusive breastfeeding	To the mothers knowledge the infant has never had any water, formula, or other liquid or solid food. From birth the infant has only received breastmilk from either the breast or expressed and prescribed medicines (as per the Medicines Act 1981).
Fully breastfeeding	The infant has been given breastmilk only, no other liquids, or solids apart from a small amount of water or prescribed medicines, in the past 48 hours.
Partial breastfeeding	The infant has been fed some breastmilk and some formula or other solid food in the past 48hrs.
Artificial breastfeeding	The infant has had no breastmilk, only breastmilk substitute such as infant formula in the past 48hrs.

Definitions from the breastfeeding definitions for monitoring the national healthy outcome targets in New Zealand. Ministry of Health. New Zealand, Feb, 1999, BFHI Document NZ-Part1 2005.

2.3.3. Breastfeeding recommendations

Prior to 2001, the WHO recommended that infants be exclusively breastfed for the first four to six months after birth, at which time complementary foods could be introduced. A review by Kramer and Kakuma (2001) focusing on the optimal duration of exclusive breastfeeding led to the WHO revising its recommendations regarding the duration of exclusive breastfeeding. The review by Kramer and Kakuma (2001) included 16 studies. Of these, two were randomised trials from Honduras whilst the remainder of the studies were observational. Seven studies involved in the review were from developing countries. The authors found that exclusive breastfeeding for six months reduced infection rates, did not cause faltering growth and prolonged lactational amenorrhea compared to exclusive breastfeeding for three or four months. They did however note that one randomised controlled trial showed infants who were exclusively breastfed for six months had lower mean haemoglobin and ferritin concentrations compared to those infants who commenced solids at four months. The authors concluded that there was no apparent risk to exclusive breastfeeding for the first six months as a general policy for infants in both developed and developing countries. They did however state that large randomised trials were needed in both developed and developing countries to determine whether this recommendation had adverse effects on growth and also to confirm the health benefits of exclusive breastfeeding for six months.

Kramer and Kakuma again reviewed the evidence regarding the optimal duration of exclusive breastfeeding in 2012. The review included 23 studies 11 from developing countries (two randomised controlled trials and nine observational studies) and 12 from developed countries (all observational studies). The authors continue to recommend that women in both developing and developed countries exclusively breastfeed their infants for the first six months after birth, as there is evidence to suggest that exclusive breastfeeding reduces gastroinfections, improves maternal weight loss after birth and delays menstruation. The review also noted however that there were no apparent differences in weight and height gains seen in infants from developed countries between those who were exclusively breastfed for six months and those who were exclusively breastfed for three to four months. The iron status of infants who were exclusively breastfed for the first six months of age in developed countries was not explored in this review. However as noted by the authors reduced iron stores at six months of age have been reported in Honduras in infants who were exclusively breastfed for six months compared to those who exclusively breastfed for four months.

Another systematic review published in 2001 (the same year as Kramer and Kakuma's first review) by Lanigan, Bishop, Kimber, and Morgan (2001) which was based on 33 studies could not find convincing evidence to support any changes to the then current recommendation of introducing complementary foods to infants at four to six months. More recent studies also suggest four to six months as an appropriate age to introduce complementary foods. Fewtrell et al. (2007) and Fewtrell, Wilson, Booth, and Lucas (2011) reviewed the evidence and raised concerns that exclusive breastfeeding until six months put infants at increased risk of iron deficiency anaemia, noting this has been highlighted in both developing and developed countries. A randomised controlled trial conducted by Jonsdottir et al. (2012) in Iceland also raised concerns regarding iron status of infants who are exclusively breastfed until six months. The authors found that infants who consumed complementary foods alongside breastmilk from four months of age had higher iron stores at six months compared to those infants who were exclusively breastfed until six months.

However, since the review by Kramer and Kakuma in 2001 the WHO has recommended exclusive breastfeeding for the first six months after birth in both developed and developing countries (Kramer & Kakuma, 2012). The New Zealand Ministry of Health shortly after the WHO made changes to its exclusive breastfeeding guidelines adopted this recommendation. Recommending that infants be exclusively breastfed until around six months of age, at which time the introduction of complementary foods should commence (Ministry of Health, 2008a).

In New Zealand and in many other developed countries a small percentage of women manage to exclusively breastfeed for the recommended six months. It has been reported that approximately 6% of women in New Zealand are currently achieving this recommendation (Morton et al., 2012). This 'one size fits all' recommendation produced by the WHO and endorsed by New Zealand's Ministry of Health is evidently unachievable for the majority of women in New Zealand. A small qualitative serial interview study of infant feeding experiences in Scotland (n=36) found that this recommendation was unachievable by many and promoting it was perceived as setting parents up to fail. The recommendation does not take into consideration social, physical, mental, and family issues that women face, which may influence their ability to successfully exclusively breastfeed. The authors recommended that possibly changing the message from 'exclusively breastfeed infants for the first six months after birth' to 'breastfeed for as long as you can' and 'introduce solids as close to six months as possible' along with individually tailored feeding plans could positively influence breastfeeding outcomes (Hoddinott, Craig, Britten, & McInnes, 2012).

2.3.4. Initiation of breastfeeding

The WHO (2001) and UNICEF (2014) recommend breastfeeding be initiated within the first hour after birth. Delays in the initiation of breastfeeding after one hour have been associated with increased risk of neonatal mortality (Khan, Vesel, Bahl, & Martines, 2015). It has been estimated that early breastfeeding initiation (within one hour) could prevent approximately one-fifth of all neonatal deaths. A study by Edmond et al. (2006) found infants who were initiated to breastfeeding after one day had a 2.4 fold increase in all-cause mortality. While those who initiated breastfeeding on day one reduced the risk

of all-cause mortality by 16.3% and if breastfeeding was initiated within the first hour their risk reduced by 22.3%. Breastfeeding initiation rates after birth is reasonably high for term infants, however they appear to be much lower for those born preterm. Donath and Amir (2008) found 92% of term infants ($n=1419$) initiated breastfeeding compared to 88.2% ($n=105$) of preterm infants. A study by Craighead and Elswick (2014) found breastfeeding non-initiation occurred more often in ETIs (OR = 1.5, 95% CI [1.26, 1.78]) whereas breastfeeding non-initiation was lower in FTIs (OR = .665, 95% CI [.559, .791]). There is insufficient data to date on the breastfeeding initiation rates of New Zealand infants. Currently the majority of New Zealand DHBs only report infant breastfeeding practices at hospital discharge.

2.3.5. Factors influencing the initiation and duration of breastfeeding

Breastfeeding is complex and the initiation and duration of breastfeeding is influenced by numerous factors both positive and negative.

2.3.5.1. Positive influences on the initiation and duration of exclusive breastfeeding

The Baby Friendly Hospital Initiative launched by UNICEF and the WHO in 1991 is an international programme created to protect, promote, and support breastfeeding. The aim of the Baby Friendly Hospital Initiative is to improve exclusive breastfeeding rates and ensure maternity services provide evidenced-based support to women and their infants. All maternity services are required to attain and maintain Baby Friendly Hospital accreditation (NZBA). The WHO and UNICEF have developed the “Ten Steps to Successful Breastfeeding” (Appendix A) to ensure maternity services worldwide provide the right start for every infant and the required support for mothers to breastfeed (WHO, 1998).

Early skin-to-skin contact has also been shown to positively benefit the initiation and duration of breastfeeding. A Cochrane Review by Moore, Anderson, Bergman, and Dowswell (2012) looked at breastfeeding rates and duration. The meta-analysis included 13 studies involving a total of 702 mother-infant pairs. The analysis noted that as an intervention skin-to-skin contact appears to benefit breastfeeding outcomes. Studies

reviewed showed those who practiced skin-to-skin contact were more likely to breastfeed at one to four months after birth compared to those who did not.

2.3.5.2. Negative influences on the initiation and duration of exclusive breastfeeding

The mode of delivery, particularly caesarean birth, is thought to negatively affect breastfeeding. It is estimated that 25.9% of all deliveries in New Zealand occur by caesarean (Ministry of Health, 2015b). At Auckland City Hospital over 30% of all births are currently caesarean births (Pot & Sadler, 2013). A systematic review by Prior et al. (2012) examined studies that reported breastfeeding outcomes by mode of delivery. The review comprised of data from over half a million women in 31 countries. The researchers found a negative association between pre-labour caesarean deliveries and early breastfeeding. Early breastfeeding was significantly lower after caesarean deliveries than vaginal deliveries. These negative associations were limited to elective pre-labour caesarean deliveries. They also found that once breastfeeding was initiated caesarean deliveries did not appear to affect breastfeeding at six months.

Maternity leave is positively linked to breastfeeding duration as studies have shown that early return to work is associated with decreased breastfeeding initiation and duration (Hawkins et al., 2007; Scott, Binns, Oddy, & Graham, 2006). The New Zealand government in 2005 increased paid maternity leave from 12 weeks to 14 weeks. In the 2014 budget the government announced changes to parental leave; from the 1st of April 2015 paid parental leave will increase to 16 weeks and from 1st April 2016 it will increase to 18 weeks paid leave. In addition to increased parental leave, payments will apply to more workers (Ministry of Business Innovation and Employment, 2014). The amount of parental leave offered regrettably does not support women and families enough for them to exclusively breastfeed infants till six months of age, as many women will have to return to work before their child turns six months, it is however a step in the right direction.

Breastfeeding difficulties are significant predictors of breastfeeding duration. There is the potential for ETI due to either their mode of birth or immature physiology to experience more difficulties with breastfeeding than term infants. (Donath & Amir, 2008; King, 2009). Two reviews by Thulier and Mercer (2009) and Gerd et al. (2012) examined reasons for

reduced breastfeeding duration among infants. The authors established that real or perceived inadequate milk supply, nipple problems, latch-on and sucking disorganisation, were the most commonly cited causes. Numerous other issues such as plugged ducts, flat/inverted nipples, medical complications such as mastitis and breast abscesses and maternal BMI ($\geq 25\text{kg/m}^2$) have also been cited to influence breastfeeding duration (Eglash, Montgomery, & Wood, 2008; Wojcicki, 2011).

Numerous other well established factors also exist which negatively influence the initiation and duration of exclusive breastfeeding in the general infant population including: socioeconomic status, maternal age, marital status, education level, maternal smoking, preterm birth (Thulier & Mercer, 2009), and maternal BMI (Forster et al., 2006).

2.3.6. Health benefits of human breastmilk

Human breastmilk is species specific, therefore making it a superior food compared to other feeds such as infant formula, which is unable to fully replicate the composition of human breastmilk (Ministry of Health, 2008a). Significant evidence is available which demonstrates compliance to the WHO recommendations of breastfeeding for the first six months after birth and beyond have important health benefits for both infants and mothers.

2.3.6.1. Benefits to the growing infant

Human breastmilk positively benefits growing infants as it reduces infant morbidity and mortality rates, particularly during the first month after birth (Khan et al., 2015). Global research has demonstrated numerous protective benefits of human breastmilk, particularly in regards to protection from a wide range of infectious diseases (Gartner et al., 2005; Ministry of Health, 2008a). Breastmilk reduces the incidence of sepsis (Khan et al., 2015), gastrointestinal tract infections (Kramer et al., 2001), respiratory tract infections (Bachrach, Schwarz, & Bachrach, 2003), and meningitis (Hylander, Strobino, & Dhanireddy, 1998), necrotising enterocolitis (Quigley & McGuire, 2014) and urinary tract infections (Mårild, Hansson, Jodal, Oden, & Svedberg, 2004). Breastfeeding has also been shown to have neurodevelopmental benefits (Isaacs et al., 2010). Fewtrell (2004)

reviewed the evidence and established that breastfed infants have improved cognitive function compared to those infants artificially fed. There is also some evidence to suggest other positive health benefits such as a reduced risk of sudden infant death syndrome (Ministry of Health, 2008a), particular cancers, for example, leukaemia, lymphomas, and Hodgkin's disease (Bener, Denic, & Galadari, 2001; Davis, 1998; Smulevich, Solionova, & Belyakova, 1999), diabetes (type I & II) (Fewtrell (2004), celiac disease (Eidelman et al., 2012), obesity and overweight (Fewtrell, 2004), asthma (Gdalevich, Mimouni, & Mimouni, 2001), atopic eczema (Kramer et al., 2001), high blood pressure (Fewtrell, 2004), hypercholesterolemia (Owen, Whincup, Odoki, Gilg, & Cook, 2002), and inflammatory bowel disease (Eidelman et al., 2012).

2.3.6.2. Maternal benefits

Mothers also experience positive health benefits from breastfeeding their infants. Breastfeeding has been shown to decrease the risk of breast (Collaborative Group on Hormonal Factors in Breast Cancer, 2002; Zheng et al., 2001) and ovarian cancer (Riman, Nilsson, & Persson, 2004; Tung et al., 2003), enhanced return to pre-pregnancy weight (Dewey, 2004), stimulates lactational amenorrhea (Kennedy, Labbok, & Van Look, 1996), and possibly reduces the risk of postmenopausal osteoporosis and hip fractures (Karlsson, Ahlborg, & Karlsson, 2005).

2.3.7. Artificial infant feeding

Breastfeeding is recommended during the first two years after birth and beyond; however not all infants are breastfed. As a result it is advised that if infants are not fed breastmilk then infant formula should be used as a substitute during the first year after birth. Infant formula provides healthy FTIs with the necessary nutrition and energy for normal growth and development up to six months of age, at which time complementary foods should be introduced (Ministry of Health, 2008a). Its composition however is considerably different, as it is unable to mimic the complexity of human breastmilk. It contains similar amounts of energy to breastmilk however concentrations of some nutrients such as protein and iron are higher as their bioavailability is much lower. Infant formula does not provide the same health benefits as breastmilk. In fact

infants are at increased risk of infections with formula feeding due to inadequate sterilisation techniques, unsafe water or improper storage of the milk powder (Ministry of Health, 2008a).

Formula feeding has also been shown to be associated with the early introduction of complementary foods (before six months of age) when compared to breastfed infants. Schiess et al. (2010) found formula fed infants ($n=1090$) were introduced to solids at a median age of 4.4 months (19 weeks) while breastfed infants ($n=588$) were introduced to solids at a median age of 4.8 months (21 weeks). Six percent of formula fed infants received complementary foods at three completed months of age and 37.2% had received complementary foods at 4 completed months of age compared to 0.6% (at three months) and 17.2% (at four months) of breastfed infants. Early introduction of complementary foods has also been shown to be associated with lower maternal age, maternal smoking and lower socioeconomic status (Fewtrell, Lucas, & Morgan, 2003; Fewtrell et al., 2007; Ministry of Health, 2008b, 2012b).

2.3.8. Contraindication to exclusive breastfeeding

While breastfeeding provides the perfect first food for infants there are a small number of medical conditions where it is not in infants' best interest to breastfeed, for instance in New Zealand and other developed countries it is not recommended that human immunodeficiency virus positive (HIV) mothers breastfeed their infants (Ministry of Health, 2012a). Infants who are born with certain metabolic disorders such as classic galactosaemia require modified formula (Eidelman et al., 2012). Mothers who have active infectious tuberculosis or active herpes may not breastfeed, however it is safe for their infant's to receive expressed breastmilk (Eidelman et al., 2012; Gartner et al., 2005). Mothers who are positive for human T-cell lymphotropic virus type I or II84 are also not recommended to breastfeed or give their infant's expressed milk (Gonçalves et al., 2010).

2.3.9. Current infant feeding practices from birth until six months of age

The New Zealand Ministry of Health in 2007 produced a number of nutritional health targets. One of these targets was to increase the number of infants exclusively breastfed

at six weeks to greater than 65%, at three months greater than 57%, and at six months greater than 27% for all ethnicities. Breastfeeding initiation rates are high in New Zealand. The GUiNZ Study that revealed during the first day after birth 96.3% of infants were breastfed and 92.8% of infants were breastfed during their first week after birth (Morton et al., 2012). Other developed countries are also experiencing relatively high breastfeeding initiation rates. However high initiation rates are not followed by increased breastfeeding duration. Once infants are in the community breastfeeding rates fall considerably. The GUiNZ study has revealed a steady decline in exclusive breastfeeding rates over the first six months. By three months 63.4% of mothers were exclusively breastfeeding and by five months 28.1% of mothers exclusively breastfed. The median age of breastfeeding cessation was four months (mean of 4.4 months) (Morton et al., 2012). A review of international statistics (**Table 3**) and the scientific literature (**Table 4**) shows similar declines in breastfeeding duration in other developed countries.

Table 3: *Exclusive breastfeeding rates in developed countries*

Author (date)	Country	BF initiated	3 – 4 months	6 months
Kristiansen, Lande, Øverby, and Andersen (2010)	Norway	92% (1 st week)	65%	10%
Morton et al. (2012)	NZ	96.3% (1 st day)	63.4%	6%
Australian Institute of Health & Welfare (2012)	Australia	90.4%	39.2%	15.4%
Statistics Canada (2013)	Canada	89%	51%	26%
McAndrews et al. (2012)	UK	81%	17%	1%
Centre for Disease Control & Prevention (2014)	USA	79.2%	40.7%	18.8%
New Zealand Ministry of Health breastfeeding targets: 65% at six weeks, 54% at three months, 27% at six months				

Currently the rates of exclusive/fully breastfed Māori infants are lower than those of European/Other infants at less than six weeks, three months, and six months. From 2004 to 2011, 60.8% of Māori babies were exclusive/fully breastfed at less than six weeks, 44.6% at three months, and 16.7% at six months. In comparison the rates of exclusive/fully breastfed European/Other infants were approximately 70% at less than six

weeks, 60% at three months and 30% at six months (Ministry of Health, 2012c). According to statistics from the New Zealand Ministry of Health breastfeeding rates have increased since 1997. However Māori infants are yet to reach the breastfeeding target set in 2007 (Ministry of Health, 2008a).

2.3.9.1. Breastfeeding practices of early term infants

The effects of gestational age at birth on the initiation and duration of breastfeeding is currently an understudied area. To date there is limited evidence available on the initiation and duration of breastfeeding amongst ETIs. In a recent retrospective cohort study by Craighead and Elswick (2014) involving ETIs ($n=4052$) and FTIs ($n=6825$) results showed being born early term was a significant predictor of non-initiation of breastfeeding ($P=<0.0001$) and breastfeeding duration of less than four weeks ($P=<0.0001$). In another study by Donath and Amir (2008), the authors found no significant difference in the initiation rate of breastfeeding between ETIs and those born greater than 40 weeks, however ETIs were significantly less likely to be breastfed at six months of age than those infants born greater than 40 weeks gestation (Table 4). Lutsiv et al. (2013) highlighted that at hospital discharge infants born 40, 39, 38, and 37 weeks' gestation experienced lower odds of being breastfed either exclusively or partially compared to those born 41 weeks. From the limited data available, infants born at early term may be at increased risk of non-initiation of breastfeeding and reduced breastfeeding duration. However future studies are required to further assess breastfeeding practices of ETIs. Currently there is insufficient evidence to make any conclusive statements regarding whether ETIs are at risk of suboptimal breastfeeding practices compared to FTIs.

Table 4: Breastfeeding duration from birth until six months of age

Reference	Study design	Country of origin	Study population	Breastfeeding Initiation	4 months	6 months
Flacking, Nyqvist, and Ewald (2007)	Prospective population based cohort study of breastfeeding infants from 1993–2001	Sweden	Term infants (n=35250) Preterm infants (n=2093)	-	82% [†] 72% [†]	69% [†] 60% [†]
Akerstrom, Asplund, and Norman (2007)	An observational study of infants born in 1996, 2001 and 2004, and studied from discharge to 6 months of post-natal age.	Sweden	Term infants (n=945) Preterm infants (n=785)	-	89% [†] 72.7%* [†]	78% [†] 60%* [†]
Donath and Amir (2008)	A Longitudinal Study of children born between March 2003 and February 2004	Australia	Full term infants (n=1880) Early term infants (n=1543) Preterm infants (n=177)	93.9% 92.0% 88.2%	-	60.5% [†] 54.5% [†] 41.2% [†]
Östlund, Nordström, Dykes, and Flacking (2010)	Population based retrospective cohort study of breastfeeding in twin infants from 1993-2001	Sweden	Term infants (n=962) Preterm infants (n=695)	-	63% [†] 58% [†]	45% [†] 39% [†]

* Corrected age used

†: Combination of exclusive and partially breastfeeding

2.4. Complementary feeding

Complementary feeding is a significant dietary event in an infant's life (Norris et al., 2002b). The introduction of solid food is vital, as eventually infants are unable to consume the necessary volumes of milk (breastmilk or formula) required to meet nutritional needs essential for optimal growth and development (Palmer & Makrides, 2012).

2.4.1. Defining complementary feeding

Complementary feeding is defined as a process that typically begins at six months of age, as it is around this time breastmilk and infant formula no longer adequately meet infants' nutritional needs. Therefore other foods and liquids are necessary along with breastmilk to meet nutrient requirements (Ministry of Health, 2008a; WHO, 2014). Complementary foods are divided into two categories: i) transitional foods – foods designed to meet the nutritional or physiological requirements of infants, and ii) family foods – foods given to young children that are similar to those consumed by the rest of the family. The transition from exclusive breastfeeding to family foods usually continues until infants are approximately 24 months of age (Ministry of Health, 2008a; WHO, 2001, 2014).

2.4.2. Physiological aspect of complementary feeding

2.4.2.1. Renal and gastrointestinal organ systems

In order for infants to metabolise complementary foods it is vital their renal and gastrointestinal systems are sufficiently matured to cope with changes to feeding practices (ESPGHAN Committee on Nutrition, 2008). Newborn infants' renal function has a limited capacity to conserve fluids and excrete and dissolve solids (Ministry of Health, 2008a). It is suggested that once infants reach approximately four months of age their renal and gastrointestinal systems are sufficiently matured to metabolise nutrients from complementary foods (Butte et al., 2004). With regards to the maturation of the gastrointestinal system it is the exposure to solid foods and the transition from a diet high in fat to one high in carbohydrates that drives digestive maturation. The ingestion of

solid food triggers hormonal responses, which help facilitate necessary changes to digestive functions. (ESPGHAN Committee on Nutrition, 2008).

2.4.2.2. Neurological development

Gross oral motor development takes place between four to five months of age enabling infants to safely cope with complementary foods (Butte et al., 2004; ESPGHAN Committee on Nutrition, 2008). Developmental readiness is an important indicator infants are ready to start solid foods and should be considered prior to their introduction (Palmer & Makrides, 2012). It is important that infants have good head control and are able to sit up unsupported. These abilities are required for fine motor control of hands and mouth, which is needed for the introduction of solids (King, 2009). Other developmental readiness cues include: infants looking as if they are able to eat from a spoon, leaning towards food when it is offered and opens their mouth (King, 2009; Palmer & Makrides, 2012), has an increased need for feeds, and has an appetite that may not be satisfied by milk alone (Cormack, 2013).

2.4.3. Nutritional aspect of complementary feeding

Complementary feeding is a period where major changes to both macro- and micronutrient consumption occurs (ESPGHAN Committee on Nutrition, 2008). Up until the age of around six months healthy term exclusively breastfed infants are able to sufficiently meet their nutritional requirements through breastmilk alone. However by six months of age the volume of breastmilk consumed alone cannot meet the nutritional demands of growing infants, as their nutritional requirements for energy, protein, iron and zinc and some fat soluble vitamins (A and D) become greater than what breastmilk alone can provide (Butte et al., 2002). Therefore delaying the introduction of complementary foods until after six months of age in exclusively breastfed infants may increase the risk of developing nutritional deficiencies and faltering growth (Ministry of Health, 2008a)

As previously mentioned healthy full term exclusively breastfed infants whose mothers had good iron stores during pregnancy are likely to have sufficient iron stores until they are approximately four to six months of age at which time iron stores become depleted

(Domellof et al., 2014). As a result, it is vitally important that breastfed infants be introduced to iron rich complementary foods around this time as they are at increased risk of developing iron deficiency or iron deficiency anaemia (Ministry of Health, 2008a). In comparison formula fed infants are at lower risk of nutritional deficiencies or faltering growth. Infant formula often has higher concentrations of some nutrients compared to breastmilk such as iron, zinc, and protein. Additionally infants consuming formula tend to consume higher volumes of milk (ESPGHAN Committee on Nutrition, 2008).

2.4.4. Recommendations for the introduction of complementary foods

The New Zealand Ministry of Health (2008a) has adopted the WHO recommendations regarding complementary feeding. Currently it recommends infants be exclusively breastfed until around six months of age at which time it is advised that infants begin to transition from a diet of breastmilk and/or formula to one that includes complementary foods. Prior to approximately six months of age it is recommended that complementary foods (solids and other liquids) be avoided. The ESPGHAN committee (2008) also agrees that exclusive or fully breastfeeding for around six months is desirable. The committee also advise complementary foods should not be introduced prior to 17 weeks of age, but should not be delayed until after 26 weeks.

The WHO (2001) defines appropriate complementary feeding as:

- *Timely* – Foods are introduced when energy and nutrients exceed what can be provided through exclusive and frequent breastfeeding;
- *Adequate* – Foods should provide adequate energy, protein, and micronutrients to meet infants recommended daily intake (RDI);
- *Safe* – Foods are stored and prepared hygienically, and children are fed with clean hands using clean utensils and not bottles and teats;
- *Properly fed* – Foods are provided according to children's appetites and satiety cues. Children are actively encouraged to consume appropriate foods for their age using fingers, spoons or self-feeding.

2.4.5. Key principles from the New Zealand Food and Nutrition Guidelines for Healthy Infants and Toddlers

The New Zealand Ministry of Health has produced a number of key guiding principles to ensure healthy growth and development of infants. It recommends: (i) infants are to be provided with appropriate food and physical activity to maintain healthy growth and development; (ii) Infants should be exclusively breastfed until around six months of age; (iii) when ready, infants are to be introduced to appropriate complementary foods and should continue to be breastfed until at least one year of age or beyond; (iv) increase the texture, variety, flavour and the amount of food offered so that infants receive a complementary intake of nutrients, especially iron and vitamin C, and that by one year of age they are eating more family foods; (v) prepare or choose pre-prepared complementary foods with no added fat, salt, sugar, honey or other sweeteners; (vi) infants who are not fed breastmilk should use an infant formula as their milk source until one year of age; (vii) infants should not have alcohol, coffee, cordials, juice, soft drinks, tea (including herbal teas), and other drinks containing caffeine; and (viii) purchase, prepare, cook and store food in ways to ensure food safety (Ministry of Health, 2008a).

2.4.7. Complementary feeding guidelines for infants

The New Zealand Ministry of Health (2008a) has produced guidelines for the introduction of complementary foods. When complementary foods are first introduced it is recommended that solid foods be provided as a 'top up' at the end of milk feeds (breast or formula), as breastmilk and formula at this time still remain the most important nutrient source. It is also recommended that infants be offered purée foods first then mashed and progress through to minced and chopped foods by eight months of age.

When beginning the introduction of complementary foods it is recommended approximately ½–2 teaspoons of a single food ingredient be offered. New foods should be introduced one at a time every two to seven days to determine the infant's tolerance to the food. As foods are tolerated, the consistency can be thickened and foods can be combined (Butte et al., 2004; Ministry of Health, 2008a). In contrast, the Australian guidelines for infant feeding do not make recommendations regarding the number of

foods that can be introduced at a single time and deem the slow introduction of solid foods as not necessary (National Health and Medical Research Council, 2012).

The nutritional qualities of first foods are important to ensure essential nutrients are being provided. A New Zealand study by Soh et al. (2002) found positive associations between serum ferritin concentrations and the intake of iron and vitamin C rich foods such as red meat, iron fortified infant cereals, infant formula, and fruit and vegetables, whereas foods high in fibre and calcium were negatively associated. These findings support the New Zealand Ministry of Health (2008a) and National Health and Medical Research Council (2012) recommendations that first foods should consist of iron-fortified baby cereal, cooked and puréed meat, poultry and fish, and cooked and puréed fruit and vegetables.

In recent years anecdotal evidence suggests baby led weaning (BLW) has gained popularity in New Zealand (Cameron, Heath, & Taylor, 2012). The philosophy behind BLW is that when complementary feeding begins infants are to be encouraged to self-feed with solid foods instead of being spoon fed puréed foods (Wright, Cameron, Tsiaka, & Parkinson, 2011). The New Zealand Ministry of Health (2014) is currently opposed to this style of feeding due to the lack of evidence published regarding its safety. For BLW to be deemed safe, studies are required to determine whether this feeding method provides adequate energy and iron.

2.4.8. Factors which influence current feeding practices

There are numerous factors influencing the introduction of solid foods to infants. Formula feeding has been linked to the early introduction of solid food compared to breastfeeding. The reasons behind this are not fully understood however some evidence suggests that economic and cultural factors along with maternal and infant cues may be of influence (Fewtrell et al., 2003; Hamlyn, Brooker, Lleinikova, & Wands, 2002). Early introduction of complementary foods has also been shown to be associated with lower maternal age, maternal BMI ($\geq 25\text{kg/m}^2$), maternal smoking and lower socioeconomic status (Fewtrell et al., 2003; Fewtrell et al., 2007; Ministry of Health, 2008b, 2012b).

2.4.9. Current complementary feeding practices

Literature in developed countries on the age that complementary foods are introduced suggests a high rate of non-adherence to complementary feeding recommendations (**Table 5**). Of nine studies reviewed, six found the average age that complementary foods were introduced to infants was between 4 and 4.5 months (Andrén Aronsson et al., 2013; Giovannini et al., 2004; Graham, Gibbons, Marraffa, Henry, & Myers, 1998; Grummer-Strawn et al., 2008; Kwavnick, Ried, Joffres, & Guernsey, 1999; Scott et al., 2009). Two more recent studies from Australia and Canada reported infants were starting complementary foods closer to international recommendations, both citing an average age of approximately 5.2 months (Amezdroz, Carpenter, O'Callaghan, Johnson, & Waters, 2015; Fegan, Bassett, Peng, & Steel O'Connor, 2015). Only two studies reported the number of infants who began complementary feeding at six months of age. Kwavnick et al. (1999) found 11% of mothers and Fegan et al. (2015) found 19.4% of mothers adhered to international recommendations waiting until six months to introduce complementary foods to their infants. Eight of the studies reviewed looked at the percentage of infants commencing solid foods before four months of age. The percentage of infants starting solids before four months varied, the lowest reported was 16% (Kwavnick et al., 1999) while three studies reported just under half (44% (Crocetti, Dudas, & Krugman, 2004; Scott et al., 2009) and 41% (Grummer-Strawn et al., 2008)) of infants had started solids by four months of age. Fewer infants commenced complementary feeding after six months of age. First foods commonly introduced were infant cereals or fruit and vegetables see Table 5.

Table 5: Studies looking at the age complementary foods are introduced to infants in developed countries

Reference	Study design	Country of origin	Study population	Average age	Introduced <4 month	Introduced at 6 month	Introduced >6 months	First food introduced
Kwavnick et al. (1999)	Survey design	Canada	Infants (n=338)	4 months	16%	11%	4%	-
Graham et al. (1998)	Survey design	Australia	Parents of children 0-2yrs (n=119)	4.3 months	29%	-	4%	-
Crocetti et al. (2004)	Cross-sectional survey	USA	Caregivers of infants (n=102)	-	44%	-	-	Cereal
Giovannini et al. (2004)	Epidemiologic al survey	Italy	Mothers of infants (n=2450)	4.3 months	34.2%	-	14.5%	Fruit
Grummer-Strawn et al. (2008)	Longitudinal mail survey	USA	Mother of infants (n=2046)	4 months	41%	-	<30%	Cereal
(Scott et al., 2009)	Longitudinal cohort	Australia	Mothers of infants (n=519)	4 months	44%	-	-	-
Andr�n Aronsson et al. (2013)	Prospective cohort study	USA & Europe	Infants (n=6404)	4.5 months	17%	-	-	Potatoes & roots
Amezdroz et al. (2015)	Cohort study	Australia	Infants (n=466)	5.2 months	20%	-	10%	-
Fegan et al. (2015)	Observational survey design	Canada	Mothers of infants (n=325)	5.2 months	-	19.4%	-	Infant cereal

2.4.9.1. Current feeding practices of infants in New Zealand

Key findings from 'The Health of New Zealand Children 2011/12 Survey' showed approximately 1 in 10 infants were given complementary foods before four months of age. This rate is slightly less (from 16% to 10%) than in the 2006/07 survey. The survey also showed Māori and Pacific children were more likely than other ethnicities to introduce complementary foods before four months of age, with 16% of Māori and 14% of Pacific infants starting solids earlier than recommended. The number of Māori infants starting complementary foods before six months of age has reduced since the 2006/07 survey (from 22% to 16%) (Ministry of Health, 2008b, 2012b). The GUiNZ study established that the most frequently introduced first food was baby rice (mean age of 5 months) followed by fruit and vegetables whereas meat tended to be introduced slightly later (mean age of 7 months) (Morton et al., 2012).

2.4.9.2. Current complementary feeding practices of early term infants

There are substantial gaps in the literature with regards to the complementary feeding practices of ETIs. There are currently no national or international studies available on their current feeding practices. This research on the complementary feeding practices of ETIs will therefore be an important contributor to the literature.

2.5. Summary

Current evidence suggests ETIs may be at increased risk of suboptimal feeding practices. Appropriate feeding practices during the first six months after birth are essential for the short- and long-term health outcomes of infants. The literature to date has produced compelling evidence to support this viewpoint. To date there is little research in New Zealand with regards to infant feeding practices of ETIs. Therefore, the primary aim of this research is to compare the feeding practices of ETIs and FTIs living in New Zealand during the first six months after birth in relation to national infant feeding recommendations and to determine the factors that influence these feeding practices.

3.0. Methods

3.1. Study design

The 'Parental reporting of feeding practices of infants in New Zealand: An observational study' is a longitudinal observational study conducted in New Zealand. The aim of the study is to describe and evaluate the feeding practices of infants born greater than 37 weeks and 0 days' gestation, from birth until 12 months of age, in relation to recommended guidelines. It will also aim to determine the factors that influence these feeding practices. This thesis will present data on all types of nutrition (milk, solids and other fluids), infant feeding practices, and the factors that influence these practices from birth until six months of age.

3.2. Ethical approval

Ethical approval for the study was granted on the 10th June 2015 by The Northern B Health Disability Ethics Committee (HDEC) (No.15/NTB/101) (Appendices B & C). The Auckland District Health Board Research Review Committee also provided their permission for this study to be carried out (A+6696) (Appendix D).

3.3. Study setting

Participants in this study were recruited from across New Zealand. In 2014, 59,402 infants were born in New Zealand; of those 90.7% were at term. The national recruitment of term infants should allow for the assessment of feeding practices of infants born early term (37 weeks and 0 days to 38 weeks and 6 days gestation) and full term (≥ 39 weeks 0 days gestation) infants.

3.4. Study population

The population in this study consists of infants born greater than 37 weeks and 0 days gestation. This study population was chosen, as to date limited information exists in New Zealand regarding the differences in feeding practices between early term infants (ETIs)

and full term infants (FTIs). The infants in this study were aged between five and nine months at the time of recruitment.

3.4.1. Eligibility

Participants were eligible to take part in this study if their infant was aged between five to nine months at the time of recruitment. If infants were five months at the time of recruitment then parents were sent the questionnaire when the infant was six months of age. All infants who met the inclusion criteria and their mothers were invited to participate in the study.

Inclusion Criteria

The inclusion criteria are as follows:

- All infants born between greater than 37 weeks and 0 days gestation.
- Must be living in New Zealand.
- Commenced solids at the time of recruitment.

Exclusion Criteria

The exclusion criteria are as follows:

- Any infants receiving on-going specialist care.
- Infants who were adopted prior to discharge from hospital.
- Infants born to mothers with social issues.
- Where not aged between five to nine months at the time of recruitment.

3.4.3. Recruitment phase one – Auckland City Hospital

The participants were recruited through National Women's at Auckland City Hospital during July 2015. With permission from the Newborn intensive care unit (NICU) and the maternity wards, contact details including name and address of potential participants were sourced from patient admission books and the hospital database with permission from the Auckland District Health Board Research Office.

Parents and caregivers of infants who were eligible to partake in the study were sent an information pack consisting of: a letter inviting them to participate (Appendix E); an information sheet (Appendix F) detailing the study, its importance, and how to register; consent forms (Appendix G); a contact details form (Appendix H); a brochure outlining the study (Appendix I); their unique study ID number; and a free post self-addressed envelope. If interested in taking part in the study, caregivers were asked to return the completed consent and contact details form in the free post envelope provided. Researchers were available over the telephone or via email to answer any questions the participants had about the study.

3.4.3.1. Informed consent

Parents or caregivers were asked to provide written informed consent through the completion of the consent form, which required a signature and date and to be returned by post in the freepost envelope provided. Consent was also confirmed online; participants were asked to tick questions one (Do you consent to taking part in this study?) and two (Do you give consent for us to view you and your baby's medical records?) of the questionnaire to say they consented to being part of the study.

3.4.3.2. Confidentiality

On the brochure, which was part of the information pack, participants were provided with a unique coding number. This unique number was the only way to identify the participants involved.

3.4.3.3. Complications associated with phase one

Due to logistical restrictions related to the recruitment process through Auckland City Hospital the initial recruitment phase was unsuccessful, as the restrictions were associated with a limited response rate to the study. Because of these logistical issues an amendment was made to the ethics application and a second phase of recruitment was implemented in order to obtain a large sample size.

3.4.4. Post approval amendment to recruitment

Additional participants were recruited through organisations such as Reach Me and social media sites targeting mothers with young infants, (such as Facebook's New Zealand's Breastfeeding Support Group), inviting mothers to take part in the study.

Participants were invited to complete an online questionnaire administered by Survey Monkey. Post approval amendments from HDEC stipulated information regarding the study was made available to potential participants. Information regarding the study was made available to participants via a website link attached to the beginning of the questionnaire. The information provided at the beginning of the questionnaire outlined its purpose, importance, and how to register. Emails and letters to organisations such as Reach Me and social media sites (Appendix J) were also sent to outline the purpose of the study, its importance, and how to register.

3.4.4.1. Informed consent

Informed consent was obtained by means of question one of the survey on Survey Monkey; the question asks 'Do you consent to taking part in this study?' This question was made compulsory to answer and participants were unable to continue the questionnaire without providing an answer.

3.4.4.2. Confidentiality

All confidential data pertaining to the participants is stored in a secure database at Massey University.

3.5. Data collection

3.5.1. Development of the six months infant feeding practices questionnaire

Parents/caregivers were asked to complete an infant feeding practices questionnaire (Appendix K), which was made available online using Survey Monkey. For those participants recruited through the initial phase of recruitment (recruitment phase one) the link to the questionnaire was located on the brochure provided in the information pack. If

participants were recruited through the post approval amendment phase (recruitment phase two) then the website link was distributed to potential participants. Participants were able to access the questionnaire at their convenience and self-complete. Hard copies of the questionnaire were made available upon request and if required the link to the questionnaire was emailed.

Questions in the questionnaire were based on the Health and Social Care Information Centre 'Infant Feeding Survey' (2010) (Health & Social Care Information Centre, 2012), The Centre for Disease and Control Prevention 'Infant Feeding Practices Study II' (2009) (Santiago, 2012), the Growing up in New Zealand (2010) 'Child Proxy Questionnaire' Growing Up in New Zealand (2012) and the New Zealand Ministry of Health guidelines for infant feeding. The ethnic groups were taken from the 2010 Growing Up in New Zealand Antenatal Questionnaire.

3.5.2. Six month infant feeding practices questionnaire

The infant feeding questionnaire consisted of 62 questions designed to assess the feeding practices of infants from birth until six months of age. Questions covered were as follows: Feeding in the first week after birth; feeding from two weeks to six months; current intake; problems with feeding; and general health questions.

3.5.3. Characteristics of participants involved in the study

Demographic statistics were also obtained, as it provided information regarding the characteristics of the participants involved. Demographic information collected included the parent/caregivers' ethnicity, and date of birth. As well as their infant's ethnicity, date of birth and gestational age at birth. These demographic questions were completed online at the end of the feeding questionnaire.

3.5.4. Data collection from medical records

During phase one, medical information regarding mother's and infant's stay in hospital after birth were obtained from the Auckland City Hospital database. Birth information was gathered from these notes, including: mother's age, parity, delivery date, type of

delivery, gestation length, infant feeding during hospital admission, birth weight, birth length and head circumference, sex, number of days under paediatric care and reasons for admission to NICU. The data collection sheet can be found in Appendix L. Informed consent was obtained from all mothers prior to medical notes being accessed. During the post approval amendment phase medical records were unable to be accessed. As a result, participants were asked a series of questions through the online questionnaire to gather this information.

3.6. Statistical analysis

Survey data were downloaded and entered into Microsoft Excel, with participants only being identified by their unique study number. Statistical analysis was performed using IBM SPSS statistics version 22 (IBM Corporation, New York, US). Variables were tested for normal distribution using the Kolmogorov-Smirnov, Shapiro-Wilk tests, and normality plots.

Descriptive statistics were used to describe infant and mother characteristics. Data are either presented as the mean and standard deviations (\pm SD) or median and inter-quartile range (IQR). Where parametric data were analysed independent t-tests were performed, whilst non-parametric data were analysed using the Mann-Whitney test. Differences between the two groups were examined using the chi-square test (X^2). Where the assumptions for X^2 were not met the Fisher's exact test was used. A significance level of $P < 0.05$ was taken as statistically significant. Data reported is rounded to one decimal place therefore percentages may not always add to exactly 100%.

Tables include the number of participants and percentage of response ('n %') for each question and the total number of responses ('N') provided on specific questions. The total number of participants answering questions varies due to numerous multiple response questions or because of missing data.

4.0. Results

4.1. Description of participants

In recruitment phase one, 770 families were contacted and 103 (13%) infants were recruited to the study, of which 87 had questionnaires completed by caregivers (**Figure 2**). During recruitment phase two, the online questionnaire was completed by 625 participants, from which 351 (56%) infants were eligible. Those not eligible to be included in the study were: not aged five to nine months at the time of recruitment or did not complete all the compulsory parts of the questionnaire.

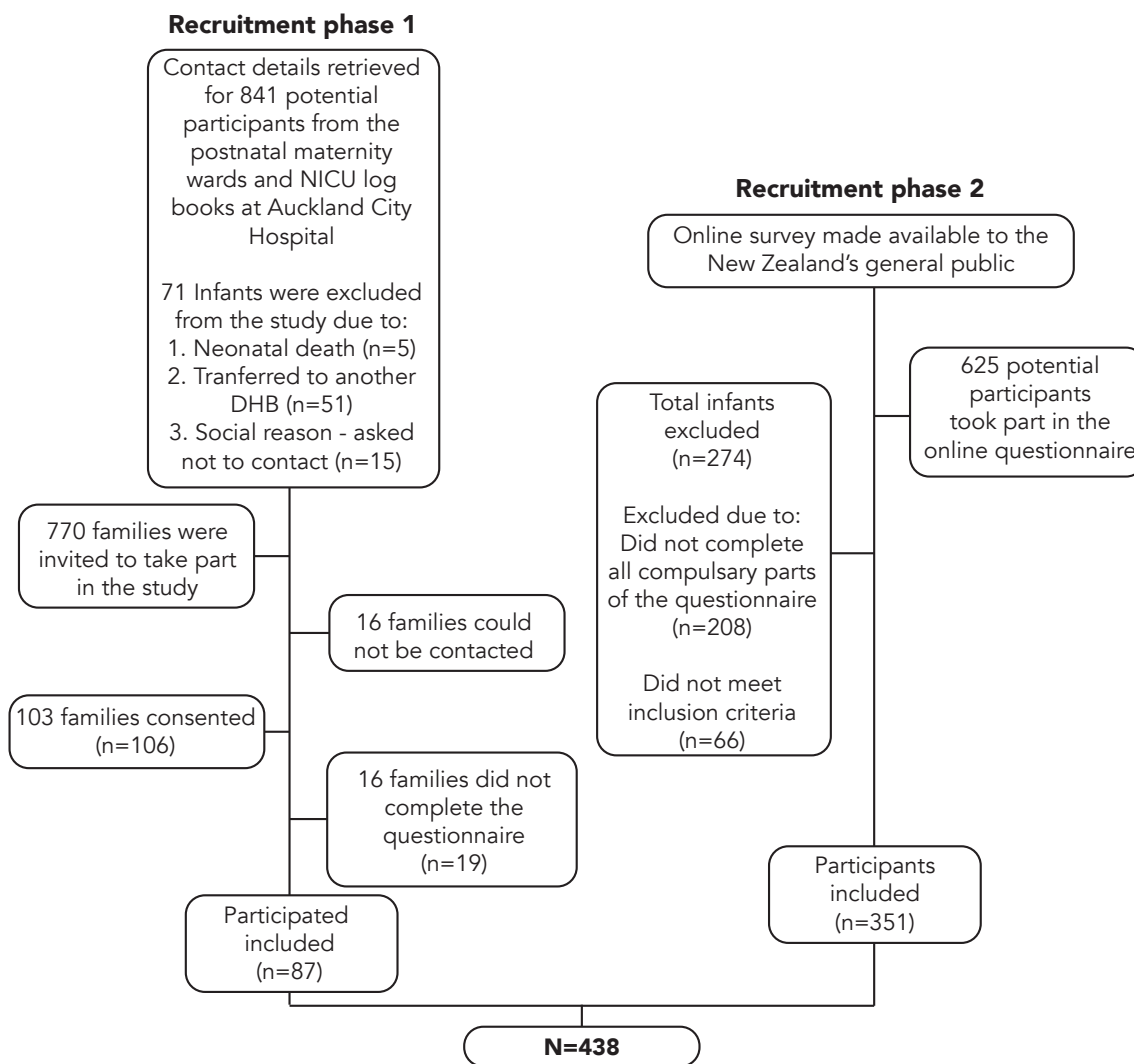


Figure 2: Profile of participants in the study

Of 438 infants included in the final analysis, 114 (26%) were born early term and 324 (74%) were born full term (**Table 6**). The majority of infants were of New Zealand European ethnicity (82.1%), followed by New Zealand Māori (7.6%), with the remainder covering a wide range of other ethnicities. Early term infants (ETIs) were less likely to have a spontaneous labour compared to full term infants (FTIs) (31.6% versus 47.5%, $P=.003$, Table 6), and were more likely to be born by elective caesarean (22.8% versus 11.1%, $P=.003$, Table 6). Additionally, ETIs were more likely to receive paediatric care (31.6% versus 18.5%, $P=.003$, Table 6) and be admitted to a Newborn Unit (14% 7.1%, $P=.007$, Table 1) compared to FTIs. Full term infants were heavier at birth than ETIs (median birth weight [IQR] 3.63 kg [3.29-3.95] versus 3.30 kg [2.30-3.60], $P<.001$, Table 6).

The mean (\pm SD) age of mothers of infants in the study was 32.6 (\pm 4.73) years (Table 6). Thirty-five percent of mothers were aged \geq 35 years. A higher percentage of mothers who gave birth to ETIs were aged \geq 35 years compared to FTIs (41.1% versus 33%), however no significance was seen between the two groups. More than half of the mothers in the study were primiparous. The most common maternal ethnicity was New Zealand European (77.8%), followed by other European (6.9%) and Asian (5%).

The participants in this study came from 91 different regions across the country. The majority of participants resided in the North Island (81.5%) with the remainder (18.1%) residing in the South Island. The most common region of residency was Auckland (46.3%) followed by Wellington (13%) and Christchurch (7.3%). The majority of ETIs lived in the North Island compared to the South Island (83% versus 17%). This was also similar for FTIs (81.5% versus 18.5%).

Table 6: Baseline characteristics of infants, and their mothers

Infant baseline characteristics	Total N=438	Full term N=324	Early term N=114	P
Gender, n (%)				
Male	207 (47.3)	148 (45.7)	59 (51.8)	.264
Female	231 (52.7)	176 (54.3)	55 (48.2)	
Birth weight (kg) [§]				
Mean (±SD)	3.5(.557)	3.6(.532)	3.3(.571)	<.001**
Gestational age at birth (wks)				
Mean (±SD)	39.6 (1.23)	40.1 (0.85)	38 (0.56)	
Mode of delivery, n (%)				
Spontaneous delivery	190 (43.4)	154 (47.5)	36 (31.6)	.003*
Induced spontaneous delivery	52 (11.9)	38 (11.7)	14 (12.3)	.875
Elective caesarean	62 (14.2)	36 (11.1)	26 (22.8)	.003*
Emergency caesarean	77 (17.6)	60 (18.5)	17 (14.9)	.384
Ventouse	38 (8.7)	25 (7.7)	13 (11.4)	.229
Forceps	19 (4.3)	11 (3.4)	8 (7.0)	.102
Paediatric care, n (%)	96 (21.9)	60 (18.5)	36 (31.6)	.003*
Admission to Newborn Unit, n (%)	39(8.6)	23(7.1)	16(14.0)	.007*
Ethnicity, n (%) [§]				
New Zealand European	358 (82.1)	268 (82.7)	90 (80.4)	
Other European	12 (2.8)	8 (2.5)	4 (3.6)	
New Zealand Māori	33 (7.6)	24 (7.4)	9 (8.0)	
Pacific Island	10 (2.3)	8 (2.4)	2 (1.8)	
Asian	15 (3.4)	11 (3.4)	4 (3.6)	
Indian	5 (1.1)	3 (0.9)	2 (1.8)	
Other	3 (0.7)	2 (0.6)	1 (0.9)	
Maternal baseline characteristics	Total N=436	Full term N=324	Early term N=112	P
Age at delivery (years)				
Mean (±SD)	32.6 (4.73)	32.3 (4.60)	33.7 (5.00)	.006**
Gravidity n (%) [§]				
Primiparous	236 (54.3)	177 (54.8)	59 (52.7)	.698
Multiparous	199 (45.7)	146 (45.2)	53 (47.3)	
Ethnicity, n (%)				
New Zealand European	339 (77.8)	252 (77.8)	87 (77.7)	
Other European	30 (6.9)	24 (7.4)	6 (5.4)	
New Zealand Māori	17 (3.9)	12 (3.7)	5 (4.5)	
Pacific Island	5 (1.1)	3 (0.9)	2 (1.8)	
Asian	22 (5)	14 (4.3)	8 (7.2)	
Indian	7 (1.6)	4 (1.2)	3 (2.7)	
Other e.g. Arabic	16 (3.7)	15 (4.6)	1 (0.9)	

[§]Missing data - Ethnicity, n=2; Birth weight, n=20; maternal age, n=2; Gravidity, n=3. *Significant differences between groups $P<0.05$ (Chi Square test). **Significant differences between groups $P<0.05$ (Independent t-test)

4.2. Milk feeding practices

4.2.1 Mode of feeding during the first week after birth

During their hospital stay 82.6% of infants in the total population were exclusively breastfeeding. Full term infants were significantly more likely to exclusively breastfeed during their hospital stay compared to ETIs (85.2% versus 75.2%, $P=.013$, **Table 7**), whilst ETIs when compared to FTIs were more likely to partially/predominately breastfeed (23% versus 14.5%, $P=.028$) compared to FTIs.

During the first week after birth, 76.5% of the total population were exclusively breastfed. FTIs were significantly more likely to exclusively breastfeed during the first week after birth compared to ETIs (79.9% versus 66.7%, $P=.016$, Table 7), whilst ETIs were more likely to partially/predominately breastfeed compared to FTIs (31.6% versus 19.4%, $P=.037$).

Table 7: Milk feeding during the first week

	Fluids	Total N=438	Full term N=324	Early term N=114	P
Hospital stay [§] , n (%)	Exclusive	361 (82.6)	276 (85.2)	85 (75.2)	.013*
	Partially/predominate	73 (16.7)	47 (14.5)	26(23.0)	.028*
	Artificially	3 (0.7)	1 (0.3)	2 (1.8)	.065
1 st week, n (%)	Exclusive	335 (76.5)	260 (79.9)	76 (66.7)	.016*
	Partially/predominate	99 (22.6)	63 (19.4)	36 (31.6)	.037*
	Artificially	4 (0.9)	2 (0.6)	2 (1.8)	.105

[§]Missing data - hospital stay, n=1

*Significant differences between groups $P<0.05$ (Chi-square test)

4.2.1 Mode of feeding during the first week after birth

During the first week after birth, almost all infants were breastfed to some degree (96.3%), but breastfeeding was more common in FTIs compared with ETIs (97.5% versus 93%, $P=.026$, **Table 8**).

Table 8: Mode of feeding in the first week after birth

Feeding mode n (%)	Total N=438	Full term N=324	Early term N=114	P
Breastfeeding	422 (96.3)	316 (97.5)	106 (93.0)	.026*
Cup/syringe	119 (27.2)	85 (26.2)	34 (29.8)	.459
Bottle	66 (15.1)	39 (12.0)	26 (22.8)	.005*
Nasogastric tube	27 (6.16)	13 (4.0)	13 (11.4)	.004*

*Significant differences between groups ($P<0.05$) (Chi-square)

4.3.1: Factors influencing the introduction of infant formula in the first week after birth

The most common factor influencing the introduction of formula in the first week after birth was 'Difficulties breastfeeding' (43.3%), followed by 'Recommended by a health care professional' (39.2%). Early term infants were more likely to be introduced to infant formula in the first week after birth as a result of jaundice (22.2% versus 7.8%, $P=.040$), low blood glucose (19.4% versus 6.3%, $P=.043$) and personal choice (19.4% versus 4.7%, $P=.018$). Early term infants were also more likely to introduce infant formula compare to FTIs due to difficulties breastfeeding (50% versus 37.5%) however this was of non-significance (**Table 9**).

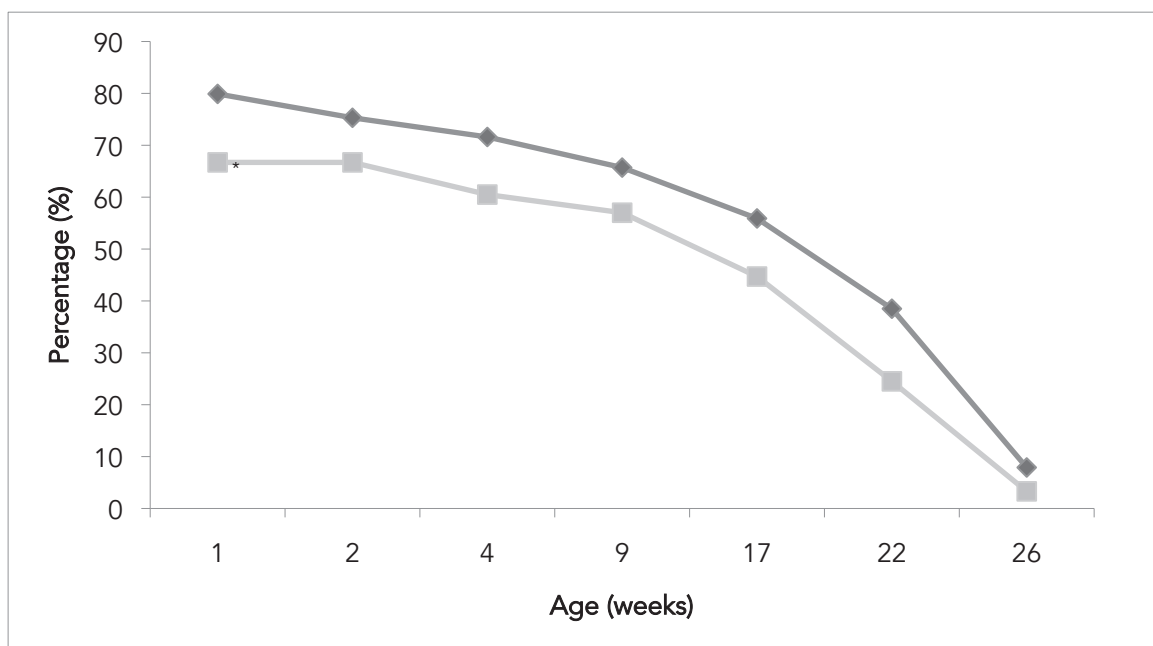
Table 9: Factors influencing the introduction of infant formula in the 1st week after birth

Reason n (%)	Study population N=100	Full term N=64	Early Term N=36	P
Difficulties breastfeeding	42 (43.3)	24 (37.5)	18 (50.0)	.224
Recommended by a health professional	38 (39.2)	25 (39.1)	13 (36.1)	.770
Other	31 (32.0)	21 (32.8)	10 (27.8)	.601
Baby losing weight	22 (22.7)	16 (25.0)	6 (16.7)	.334
Jaundice	13 (13.4)	5 (7.8)	8 (22.2)	.040*
Low blood glucose	11 (11.3)	4(6.3)	7(19.4)	.043*
Personal choice	10 (10.3)	3(4.7)	7(19.4)	.018*

*Significant differences between groups $P<0.05$ (Chi square)

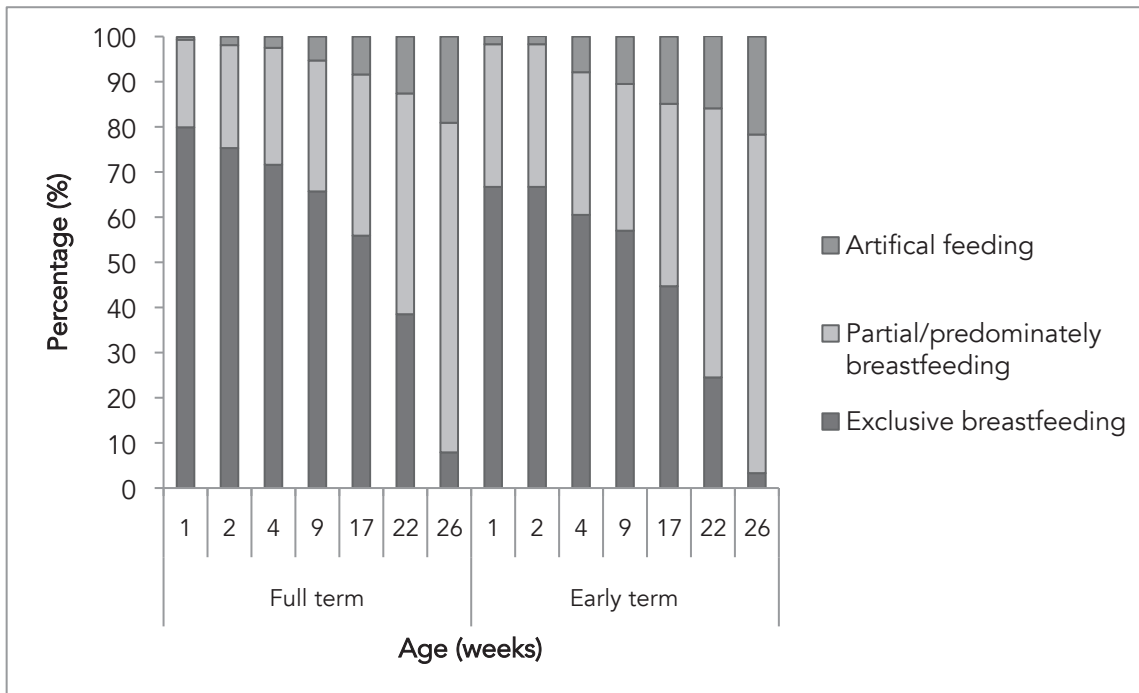
4.2.3. Infant milk feeding practices from hospital stay until six months of age

Once discharged from hospital exclusive breastfeeding rates from the study population decreased significantly between week one and six months, from 76.5% to 5.0%, $P < .001$ (**Figure 3**). Figures 3 and 4 shows that from week one until six months of age FTIs were more likely to exclusively breastfeed compared to ETIs. Full term infants were significantly more likely to exclusively breastfeed at week one, week four, week 17 and week 22 ($P = .016$, $P = .029$, $P = .040$ and $P = .014$ respectively) compared to ETIs. Both ETIs and FTIs exclusive breastfeeding rates saw the greatest decline from week 17 onwards. By week 26 similar exclusive breastfeeding rates were seen between the two groups.



*Significant differences between groups $P < 0.05$ (Chi square)

Figure 3: Exclusive breastfeeding rates of ETIs and FTIs



[§] Missing data - 1 month, n=6; 2 months, n=4; 4 months, n=2; 5 months, n=86; 6 months, n=117

Figure 4: Milk feeding from week one until six months

4.2.4: Feeding issues from birth until six months of age

During the first week after birth 42% of the study population experienced feeding issues. Mothers of ETIs were significantly more likely to report experience feeding issues compared to mothers of FTIs (51.8% versus 38.9%, $P=.015$) (**Table 10**). From week two onwards, FTIs and ETIs experienced similar rates of feeding issues (38.9% versus 39.5%). No significant differences in feeding problems were seen between the groups from two weeks onwards.

Table 10: Feeding issues form birth until 6 months of age

Age after birth, n (%)	Study population N=355	Full term N=251	Early term N=104	P
1st week after birth	184 (42.0)	125 (38.9)	59 (51.8)	.015*
2 nd week – 6 months	171 (39.0)	126 (38.9)	45 (39.5)	.912

*Significant differences between groups $P<0.05$ (Chi-square test)

4.2.5. Mother and infant feeding issues

Eighty-one percent of mothers reported experiencing some sort of feeding issue. The majority of mothers identified poor latch during breastfeeding (45.3%), painful breastfeeding (35.1%) and insufficient breastmilk supply (33.1%) as their main feeding issues experienced during the first six months after their infants birth. No significant differences were seen between ETIs and FTIs. However, slightly more ETIs experienced poor latch during breastfeeding when compared to FTIs (50.5% versus 43.5%) (**Table 11**).

Table 11: Mother and infant feeding issues from after hospital discharge

Problem, n (%)	Study population N=353	Full term N=262	Early term N=91	P
Poor latching	160 (45.3)	114 (43.5)	46 (50.5)	.245
Painful breastfeeding	124 (35.1)	95 (36.3)	29 (31.9)	.450
Low breastmilk supply	117 (33.1)	86 (32.8)	31 (34.1)	.828
Mastitis	97 (27.5)	76 (29.0)	21 (23.1)	.275
Colic / excessive crying	64 (18.1)	43 (16.4)	21 (23.1)	.081
Not growing well	63 (17.8)	45 (13.9)	18 (15.8)	.576
Reflux not requiring medication	56 (15.9)	37 (14.1)	19 (20.9)	.191
Reflux requiring medication	56 (15.6)	39 (14.9)	16 (17.6)	.129
Milk intolerance	25 (7.1)	16 (6.1)	9 (9.9)	.225
Other	12 (3.4)	8 (3.1)	4 (4.4)	.543
Tongue tie	22 (6.2)	14 (5.3)	8 (8.8)	.241

*Significant differences between groups $P < 0.05$ (Chi-square test)

4.2.6. Reasons for breastfeeding cessation from two weeks to six months

By around six months 22.8% of infants had ceased breastfeeding. The main factors influencing breastfeeding cessation were: insufficient milk supply (55%), breastfeeding difficulties (39%), and personal choice (28%). No significant differences were seen between FTIs and ETIs (**Table 12**).

Table 12: Factors influencing breastfeeding cessation from two weeks to six months of age

Reason, n (%)	Study population N=100	Full term N=68	Early term N=32	P
Insufficient milk supply	55 (55.0)	37 (54.4)	18 (56.5)	.323
Breastfeeding difficulties	39 (39.0)	27 (39.7)	12 (37.5)	.833
Baby seemed hungry	22 (22.0)	15 (22.1)	7 (21.9)	.983
Personal choice [§]	28 (28.0)	20 (29.4)	8 (25.0)	.647
Going back to work	19 (19.0)	13 (19.1)	6 (18.8)	.965
Concerned about baby's growth [§]	16 (16.0)	12 (19.0)	4 (15.4)	.682
Recommended by health professional	13 (13.0)	8 (11.8)	5 (15.6)	.592

[§] Missing data - Personal choice, n=6; Concerned about baby's growth, n=4.

*Significant differences between groups $P < 0.05$ (Chi-square test)

4.2.7. Breastfeeding support provided to mothers by health care professionals

Sixty-two percent of mothers discussed infant feeding with a health care professional. The majority of those who discussed breastfeeding with a healthcare professional did so with a midwife (45.7%) or Plunket nurse (42.9%).

4.2.8. Additional breastfeeding support provided to mothers

The most commonly cited additional support came from husbands/partners (67.8%) followed closely by Whānau /family (60.3%).

4.3. Complementary feeding practices of infants

4.3.1. Age of introduction of complementary foods

Seventy-eight percent of infants were introduced to complementary foods between 17 to 26 weeks of age. The median (IQR) age complementary foods were introduced was 22.8 (20.4-25.4) weeks (**Table 13**). No differences were seen between the two groups regarding the time of the introduction of complementary foods. Full term infants commenced complementary feeding at a median age of 22.7 (20.5-25.43) weeks and ETIs at 22.9 (20.1-25.4) weeks. A small number of mothers reported starting their infant on complementary foods prior to 17 weeks ($n=21$) and 76 mothers reported commencing complementary feeding after 26 weeks.

Table 13: Age complementary feeding commenced

	Study population N=437	Full term N=323	Early term N=114	P
Age complementary feeding commenced (wks) Median [IQR]	22.8 (20.4-25.4)	22.7 (20.5-25.4)	22.9 (20.1-25.4)	.874
Introduced to solids <17 weeks of age, n (%)	21 (4.9)	14 (4.4)	7 (6.3)	.971
Introduced to solids >26 weeks of age, n (%)	76 (17.4)	53 (16.4)	23 (20.2)	.564

**Significant differences between groups $P<0.05$ (Mann-Whitney)

4.3.2. First foods introduced to infants

The most popular first foods were vegetables (34.8%), followed by infant baby rice or cereal (33.0%) and fruit (20.0%) (**Table 14**). Only one infant (0.2%) consumed fish as their first food and none of the infants received red meat as their first solid food. Other first complementary foods introduced were chicken broth, crackers, vegetable curry, quinoa cereal, cooked egg yolks and crust from a toasted sandwich with a piece of raw apple.

Table 14: *First foods introduced to infants*

First foods introduced, n (%)	Study population ^s N=437	Full term ^s N=323	Early term N=114	P
Vegetable	152 (34.8)	112 (34.7)	40 (35.1)	1.00
Infant baby rice or cereal	144 (33.0)	113 (35.0)	31 (27.5)	.134
Fruit	90 (20.5)	60 (18.6)	30 (26.3)	.082
Ready made baby food	33 (7.6)	24 (7.4)	9 (7.9)	.839
Other	7(1.6)	6 (1.9)	1 (0.9)	.839
Yoghurt	5 (1.1)	5 (1.5)	0 (0.0)	.333
Rusk	3 (0.7)	1 (0.3)	2 (1.8)	.168
Breakfast cereal	2 (0.5)	2 (0.6)	0 (0.0)	1.00
Fish	1 (0.2)	0 (0.0)	1 (0.9)	.261
Red Meat	0 (0.0)	0 (0.0)	0 (0.0)	-

^sSignificant differences between groups $P < 0.05$ (Chi-square test)

4.3.3. Foods introduced in the first two weeks after complementary feeding commenced

By the end of the first two weeks after complementary feeding had commenced infants were introduced to a variety of foods (**Table 15**). The most common foods consumed during this time were: vegetables (85.2%), fruit (77.9%), and baby rice (46.8%). A small number of infants had begun to consume meat products during this time. More FTIs introduced meat products such as red meat, 13.6%, and chicken, 12.0% compared to ETIs 7.0% and 7.9% respectively.

Table 15: Foods introduced in the first two weeks after complementary feeding commenced

Foods introduced, n (%)	Study population N=437	Full term N=323	Early term N=114	P
Vegetables	373 (85.2)	275 (84.9)	98 (86.0)	.879
Fruit	341 (77.9)	248 (76.5)	93 (86.0)	.296
Baby rice	205 (46.8)	151 (46.6)	54 (47.4)	.913
Ready made	139 (34.0)	108 (33.3)	41 (36.0)	.649
Baby cereal	120 (27.4)	85 (26.2)	35 (30.7)	.393
Rusk	96 (21.9)	71 (21.9)	25 (21.9)	1.00
Red meat	52 (11.9)	44 (13.6)	8 (7.0)	.066
Chicken	48 (11.0)	39 (12.0)	9 (7.9)	.295
Yoghurt	31 (7.1)	28 (8.6)	3 (2.6)	.033*
Fish	23 (5.3)	19 (5.9)	4 (3.5)	.465
Breakfast cereal	12 (2.7)	8 (2.5)	4 (3.5)	.519
Pork	9 (2.1)	8 (2.5)	1 (0.9)	.457

*Significant differences between groups P<0.05 (Fisher exact test)

4.3.4. The introduction of meat products

Fifty-nine percent of infants had been exposed to red meat. The mean (\pm SD) age at which red meat was introduced was 27.5 (\pm 4.39) weeks. Fifty-six percent of infants had been introduced to white meat, at a mean (\pm SD) age of 28.2 (\pm 4.61) weeks.

4.3.5 Infant feeding style

Mothers were asked about whether they commenced their infant on puréed foods, a combination of puréed and 'whole' foods or followed baby-led weaning. Most mothers reported commencing complementary feeding with puréed foods (57.3%) or a combination of puréed and whole foods (31.9%) (**Table 16**). Eleven percent of infants were following a baby led weaning approach.

Table 16: *Infant feeding styles*

Feeding style, n (%)	Study population N=436	Full term N=323	Early term N=113	P
Puréed foods	250 (57.3)	178 (55.1)	72 (63.7)	.279
Combination	139 (31.9)	108 (33.4)	31 (27.4)	
Baby led weaning	47 (10.8)	37 (11.5)	10 (8.8)	

*Significant differences between groups $P < 0.05$ (Chi-square test)

Within the study population the majority of mothers (92.4%) were providing solid foods after milk feeds. Infants were offered a mean of 2.61 (± 0.96) solids per day.

4.3.6: Diversity of complementary foods

Table 17 details the types of foods which infants were exposed to after starting complementary feeding. By around six months of age the majority of infants had been exposed to a range of foods. The most commonly consumed foods included: starchy vegetables (94.1%), carrots (90.2%), other fruits such as apples and pears (89.7%) and pumpkin (89.3%). More infants were now consuming meat and meat alternatives; the most popular meat products eaten by the study population included: beef (62.1%) and chicken (59.1%). A small proportion of the total infant population was consuming luncheon or sausages (11.2%) and 11.9% were eating nuts and/or seeds. A number of infants were consuming processed snack foods such as biscuits and cakes, potato chips and hot chips (9.4% biscuits and cakes, 3.7% potato chips, 11.9% hot chips). The addition of sugar and salt was also minimal in the study population group, 1.8%, and 8.0% respectively. Nineteen percent of infants were consuming oils.

Sixty-three percent of mothers reported that their infants had introduced baby rice or cereal at some point in time during the introduction of complementary foods. Of these, 60.7% of the study population were consuming store bought products, 2.3% were consuming homemade baby rice or cereal. The most commonly consumed foods were homemade (57.7%) followed by a combination of store bought and homemade products (34.1%).

Table 17: Foods introduced to infants after 6 months of age

Food, n (%)	Study population N=438	Full term N=324	Early term N=114	P
<i>Breads/cereals/pasta</i>				
Bread/ toast	224 (51.1)	175 (54.0)	49 (43.0)	.043*
Baby cereal	215 (49.1)	156 (48.1)	59 (51.8)	.685
Rusks	214 (48.9)	150 (46.3)	64 (56.1)	.071
Rice	181 (41.3)	137 (42.3)	44 (38.6)	.651
Pasta	178 (40.6)	137 (42.3)	41 (36.0)	.237
Crackers	152 (34.7)	119 (36.7)	33 (28.9)	.254
Rolled oats	121 (27.6)	93 (28.7)	28 (24.6)	.395
Weetbix	90 (20.5)	69 (21.3)	21 (18.4)	.513
Breakfast cereals	28 (6.39)	17 (5.2)	11 (9.6)	.217
Congee	18 (4.1)	13 (4.0)	5 (4.4)	.863
<i>Protein</i>				
Beef	272 (62.1)	198 (61.1)	74 (65.0)	.472
Chicken	259 (59.1)	190 (58.6)	69 (60.5)	.725
Lamb	190 (43.4)	144 (44.4)	46 (40.4)	.448
Eggs	169 (38.6)	127 (39.2)	42 (36.8)	.657
Fish	163 (37.2)	118 (36.4)	45 (39.5)	.562
Beans, Lentils, chickpeas	136 (31.1)	103 (31.8)	33 (28.9)	.573
Pork or Ham	86 (19.6)	65 (20.1)	21 (18.4)	.704
Nuts and/or seeds	52 (11.9)	43 (13.3)	9 (7.9)	.127
Luncheon or sausage	49 (11.2)	34 (10.5)	15 (13.2)	.438
Tofu	12 (2.7)	8 (2.5)	4 (3.5)	.559
<i>Dairy</i>				
Yoghurt	186 (42.5)	140 (43.2)	46 (40.4)	.595
Cheese	178 (40.6)	136 (42.0)	42 (36.8)	.337
Custard	122 (27.9)	88 (27.2)	34 (29.8)	.585
Butter or margarine	120 (27.4)	99 (30.6)	21 (18.4)	.012*
Ice cream	26 (5.9)	23 (7.1)	3 (2.6)	.083
<i>Vegetables</i>				
Starchy	412 (94.1)	304 (93.8)	108 (94.7)	.724
Carrots	395 (90.2)	292 (90.1)	103 (90.4)	.944
Pumpkin	391 (89.3)	289 (89.2)	102 (89.5)	.935
Cruciferous	286 (65.3)	219 (67.6)	67 (58.8)	.089
Beans and peas	232 (53.0)	169 (52.2)	63 (55.3)	.724
Leafy greens	204 (46.6)	155 (47.8)	49 (43.0)	.371

Food, n (%)	Study population N=438	Full term N=324	Early term N=114	P
<i>Fruit</i>				
Other fruit e.g. apples & pears	391 (89.7)	290 (89.5)	101 (88.6)	.798
Banana	376 (85.8)	274 (84.6)	102 (89.5)	.196
Avocado	284 (64.8)	218 (67.3)	66 (57.9)	.071
Berries	226 (51.6)	173 (53.4)	53 (46.5)	.205
Stone fruit	190 (43.4)	139 (42.9)	51 (44.7)	.734
Tropical	172 (39.5)	127 (39.2)	45 (39.5)	.959
Salad fruit and vegetables	172 (39.3)	134 (41.4)	38 (33.3)	.131
Citrus	144 (32.9)	11 (34.9)	31 (27.2)	.133
Melon	72 (16.4)	59 (18.2)	13 (11.4)	.092
<i>Snack food</i>				
Hot chips/ fries	52 (11.9)	41 (12.7)	11 (9.6)	.593
Dried fruit	51 (11.6)	37 (11.4)	14 (12.3)	.815
Biscuits and cake	41 (9.4)	30 (9.3)	11 (9.6)	.947
Popcorn	6 (1.4)	6 (1.9)	0 (0.0)	.325
Chocolate	6 (1.4)	5 (1.5)	1 (0.9)	.803
Muesli bar	3 (0.7)	3 (0.9)	0 (0.0)	.559
Chips/ crisps	16 (3.7)	12 (3.7)	4 (3.5)	.927
Sweets/Lollies	2 (0.5)	2 (0.6)	0 (0.0)	.609
<i>Extras</i>				
Oil	84 (19.2)	62 (19.1)	22 (19.3)	.970
Salt	35 (8.0)	24 (7.40)	11 (9.64)	.448
Honey	10 (2.3)	8 (2.47)	2 (1.75)	.660
Sugar	8 (1.8)	8 (2.47)	0 (0.0)	.090
Golden syrup	4 (0.9)	4 (0.12)	0 (0.0)	.233

*Significant differences between groups $P < 0.05$ (Chi-square test)

4.3.7: Factors influencing the introduction of complementary foods

Table 18 shows that the most common reason for the introduction of solids was 'Baby was interested in foods the family was eating' (85.4%) followed by 'Baby was old enough' (65.3%) and 'Baby seemed hungry' (56.4%).

Table 18: Factors influencing the introduction of complementary foods

Reason, n (%)	Study population N=437	Full term N=323	Early term N=114	P
Baby was interested in foods the family were eating	374 (85.4)	278 (85.8)	96 (84.0)	.117
Baby was old enough	286 (65.3)	213 (65.7)	73 (64.0)	.155
Baby seemed hungry	247 (56.4)	182 (56.2)	65 (57.0)	.706
Recommended by a health professional	123 (28.1)	91 (28.1)	32 (28.1)	.879
Baby was waking at night	109 (24.9)	79 (24.4)	30 (26.3)	.317
Recommended by family/friend	55 (12.6)	36 (0.11)	19 (0.17)	.654

*Significant differences between groups $P < 0.05$ (Fisher exact test)

4.3.8: Developmental cues used to determine infant readiness for complementary foods

The majority of mothers identified 'Was able to hold his/her head up well' (92.7%) and 'Leant forward towards food when it was offered and opened his/her mouth' (92.4%) as the most common signs that their infant was ready to commence complementary feeding (**Table 19**). Mothers of FTIs were more likely to identify the developmental cue 'He or she sat up without help' compared to ETIs (44.1% versus 32.5%, $P = .028$).

Table 19: Developmental cues used to determine readiness for complementary foods

Development cues, n (%)	Study population N=437	Full term N=323	Early term N=114	P
Was able to hold his/her head up well	405 (92.7)	298 (92.3)	107 (93.9)	.573
Leant forward towards food when it was offered and opened his/her mouth	363 (82.9)	266 (82.1)	97 (85.1)	.503
Didn't push food out of his/her mouth straight away	307 (70.1)	230 (71.0)	76 (67.5)	.462
Looked as if he/she was able to eat from a spoon	281 (64.2)	204 (63.0)	77 (67.5)	.401
He or she sat up without help	180 (41.2)	143 (44.1)	37 (32.5)	.028*

*Significant differences between groups $P < 0.05$ (Chi-square test)

4.3.9. Additional support required by mothers

Mothers were asked whether they required any additional support regarding infant feeding. Fifty-eight percent of mothers felt they had received enough support. Those that did not feel adequately supported reported they would like additional support for starting solid foods (20.3%), breastfeeding (17.4%), and infant formula (13.9%).

5.0. Discussion

The aim of this study is to compare the feeding practices of early term infants (ETIs) and full term infants (FTIs) living in New Zealand from birth until six months of age, in relation to national infant feeding recommendations and to determine the factors that influence these feeding practices. This will be one of the first exploratory studies in New Zealand to determine if there are any differences in feeding practices between ETIs and FTIs.

Early term infants were until recently regarded as term infants (Dong et al., 2012). Term infants (those infants born greater than 37 weeks gestation) have previously been considered healthy and not to have increased risks associated with their gestational age at birth (Reddy et al., 2011; WHO, 2011). However, there is emerging evidence which suggests that differences may exist between ETIs and FTIs in regards to health and educational outcomes (Boyle et al., 2012; Chan & Quigley, 2014). Recently the Ministry of Health (2015b) along with other research bodies such as the National Maternity Monitoring Group (2014) have begun to report on the number of early term births occurring in New Zealand. However, there is still limited data available in New Zealand regarding these infants. This present study adds to the increasing body of literature on the occurrence and health outcomes of ETIs and provides information on the feeding practices of ETIs in New Zealand.

Retrospective data on feeding practices from birth to six months of age was collected so that any differences in breastfeeding and complementary feeding practices between ETIs and FTIs could be explored. Infancy is a vulnerable period, as it is during this time nutrition has profound biological effects which significantly influence physical development, cognitive ability, as well as short- and long-term health outcomes (Black et al., 2008; Bryce et al., 2008; ESPGHAN Committee on Nutrition, 2008). Suboptimal feeding practices such as reduced breastfeeding duration and the inappropriate timing and types of complementary foods offered, puts infants at risk of faltering growth (Norris et al., 2002b), malnutrition (WHO, 2001), nutritional deficiencies (Norris et al., 2002b),

and poorer neuro-developmental outcomes (Aggett et al., 2006; Lindstrom et al., 2011). Consequently, it is vital that infants receive optimum nutrition during this time.

5.1. Maternal and obstetric characteristics

The study population was recruited through Auckland City Hospital between April and June 2015 and nationally from September to November 2015. In total 438 term infants were included in the study. The mean gestational age of the study population was 39 weeks and 6 days and the majority of the infants (74%) were born after 39 weeks gestation. This is similar to New Zealand national birth rates, however not directly comparable. The New Zealand Ministry of Health (2015b) 'Report on Maternity' reported that the median gestation for infants born in New Zealand was 39 weeks. The 'Growing Up in New Zealand' (GUINZ) study also found a similar number (71.6%) of infants were born after 39 weeks gestation (Morton et al., 2012).

Considerable differences were seen between the delivery modes of ETIs and FTIs. This study found that ETIs were significantly more likely to be delivered by means of elective caesarean birth and significantly less likely to be delivered spontaneously compared to FTIs. These findings are also in line with international and national data which has shown that the number of elective births are rising, along with an increase in the number of infants being born before 39 weeks gestation (Menacker & Hamilton, 2010; Ministry of Health, 2015b; Morris et al., 2012; National Maternity Monitoring Group, 2014). Studies have shown that when policies are implemented at hospital level to reduce the number of early elective deliveries there has been a substantial decline in the amount of elective deliveries at early term (Lu & Johnson, 2014; Ohio Perinatal Quality Collaborative Writing Committee, 2010; Oshiro, Henry, Wilson, Branch, & Varner, 2009; Oshiro et al., 2013). Oshiro et al. (2013) assessed the effects of implementing policies and procedures for scheduling elective deliveries, known as the 'Rapid Cycle Process Improvement Program', in 26 hospitals across America. After the implementation of the program the authors found a significant decrease in the number of scheduled elective early term births, from 27.8% to 4.8% in 12 months.

Those infants born early term in this study were significantly more likely to be admitted under paediatric care during their hospital stay following birth and were significantly more likely to be admitted to a newborn care unit. This finding is consistent with previous literature, which has found ETIs experience more admissions to newborn care units compared to FTIs. A retrospective study in Canada by authors Brown et al. (2014) involving 38,807 infants of which 24.75% were early term and 70.51% were full term found 7.7% of ETIs were more likely to be triaged or admitted to a newborn intensive care unit (NICU) compared to 4.6% of FTIs, $P < .001$. Another retrospective study in America by authors Craighead and Elswick (2014) involving 4052 ETIs and 6825 FTIs found similar results, 10.8% of ETIs were admitted to NICU compared to 7.2% of FTIs, $P < .001$. Requiring medical support following birth is concerning for numerous reasons as it may be associated with potential long-term health effects, such as subtle developmental impairments (Dong et al., 2012) and behavioural and emotional problems (Lindstrom et al., 2011). It is also likely to increase parental anxiety and it places additional pressure on health resources.

The mean (\pm SD) age of the mothers of infants in the study was 32.6 (\pm 4.7) years. This is slightly higher than the national median recently reported in the 'Report on Maternity, 2014' by the New Zealand Ministry of Health (2015b), however it is not directly comparable since the Ministry of Health (2015b) reports on the median age of women in New Zealand giving birth compared to this present study which reports on the mean age. The report revealed the median age of women giving birth in New Zealand in 2014 was 30 years, with the majority of women giving birth aged between 30 to 34 years. The age of the mothers in this study cannot be viewed as representative of the total New Zealand population, as mothers in this study had an interest in the topic and self-selected to complete the questionnaire.

Mothers of ETIs were more likely to be older than those mothers who gave birth to FTIs (33.7 years versus 32.4 years, $P = .006$). A higher percentage of mothers in this study who delivered their infants early term were also aged 35 years and over compared to FTIs (41.1% versus 33.0%). Advancing maternal age (greater than 35 years) appears to be associated with an increase in caesarean births, although uncertainty exists regarding the

reasons for this association. Some possible reasons for this association include: inefficiency of the aging myometrium, the increased number of older women experiencing chronic medical diseases and certain maternal complications such as preeclampsia and gestational diabetes (Bayrampour & Heaman, 2010; Ministry of Health, 2015b). Emerging data also reveals that advanced maternal age may be a contributing factor associated with increased elective inductions and caesarean births prior to 39 weeks gestation (Menacker & Hamilton, 2010; Tita et al., 2009). Collectively, this data suggests that advanced maternal age is a risk factor for early term birth, though the reasons for this association have not been adequately explored.

5.2. Milk feeding practices

5.2.1. Breastfeeding during hospital stay and the first week after birth

Eighty-three percent of infants in this study were receiving breastmilk during their hospital stay after birth, by week one 76.5% of infants were still exclusively breastfeeding. These numbers are considerably lower than the exclusive breastfeeding rates documented by the GUiNZ study published in 2012. Morton et al. (2012) reported that by week one 92.8% of infants continued to be exclusively breastfed. It is unknown why higher exclusive breastfeeding rates were seen during the first week in the GUiNZ study. It may possibly be related to the different methods of data collection used between the studies. Compared to this study, the GUiNZ study only recruited pregnant women from selected regions in New Zealand (Auckland, Counties Manukau and Waikato District Health Board regions), therefore is not a true reflection of New Zealand breastfeeding practices. Additionally the GUiNZ study used a face-to-face computer assisted personal interview at nine months, whereas this present study collected data through an anonymous online questionnaire. Women may have been more likely to be honest whilst using the online questionnaire compared to the face-to-face interview, as it is free from judgement and interview bias. The results from this study, however, are similar to those reported by the Ministry of Health (2015) at two weeks' (73.7% versus 68.6%).

Early term infants in this study were significantly less likely to be fed from the breast during their hospital stay and during the first week after birth. They were also significantly

more likely to be bottle fed or fed via a nasogastric tube. This study supports emerging evidence that suggests ETIs are more likely to experience reduced breastfeeding initiation rates and more breastfeeding difficulties compared to FTIs. A recent study by Craighead and Elswick (2014) found significant differences in the rates of non-initiation of breastfeeding between ETIs and FTIs, with non-initiation of breastfeeding occurring more often in ETIs (OR = 1.5, 95% CI [1.26, 1.78]) compared to FTIs (OR = .665, 95% CI [.559, .791]). It would appear discrepancies exist between ETIs and FTIs in regards to exclusive breastfeeding rates, with more ETIs considerably more likely to miss out on the health benefits breastmilk provides during the first few days after birth.

5.2.2. Factors influencing milk-feeding practices in the first week after birth

Twenty-five percent of ETIs received infant formula during their hospital stay and 33.4% received infant formula during their first week compared with FTIs, 14.8% and 17.3% respectively. Early term infants were significantly more likely than FTIs to be introduced to infant formula due to jaundice and low blood glucose levels when compared to FTIs. More ETIs received infant formula due to breastfeeding difficulties compared to FTIs, however no significance was found between the two groups.

The reductions in exclusive breastfeeding rates seen by ETIs in their first week, appears to be related to 1) breastfeeding difficulties. Mothers of ETIs reported experiencing significantly more feeding difficulties during the first week after birth compared to FTIs. 2) The higher rates of admissions to baby care units experienced by these infants. Admissions to baby care units reduce infants' access to breastmilk as a result of being separated from their mothers.

Of interest, ETIs were also more likely to be introduced to formula due to personal choice compared to FTIs. This could also be attributed to the difficulties mothers experience feeding their infant during this time. It is unknown why mothers of ETIs were more likely to report introducing formula to their infant due to personal choice, as this was not explored in detail in this study.

Whilst breastfeeding difficulties experienced by women during the first week after birth were not explored in depth in this present study, women in the total population did identify general feeding issues such as poor latch, breastfeeding pain and low milk supply as difficulties hindering their ability to successfully breastfeed their infant.

5.2.3. Exclusive and fully breastfeeding rates at six months of age

During the first six months after birth there was a steady decline in exclusive breastfeeding rates. By six months of age 5% of all infants were still exclusively breastfeeding. Similar exclusive breastfeeding rates were seen between ETIs and FTIs. These figures are comparable to that reported in the GUiNZ study. Morton et al. (2012) reported 6.0% of infants were exclusively breastfed at six months of age. The results of this study do, however, differ to that reported by Plunket New Zealand. In 2014 Plunket New Zealand reported 17% of infants were exclusively breastfeeding at six months.

Although Plunket results are higher than that reported in this present study and the GUiNZ study there are a number of limitations with the data presented. Plunket sees approximately 90% of the population; however there is 10% of the population that is not accounted for. Additionally, those women counted at the six month time point are the ones who have had core contact with the Plunket organisation at that particular age.

Some experts are beginning to question the WHO guidelines that infants should be exclusively breastfed for the first six months after birth, as evidence has demonstrated there is no difference in growth between exclusively breastfed infants who are exposed to solids at four or six months. Additionally there are concerns that exclusive breastfeeding for six months puts infants at risk of reduced iron stores. Only one randomised controlled trial ($n=119$ infants born greater than 37 weeks gestation) in a developed country, has looked at the introduction of complementary foods in infancy and the effects on growth and iron status during the first six months. The authors of the study randomly assigned singleton infants to receive either complementary foods in addition to breastmilk from age four months or to exclusively breastfeed for six months. Dietary information was collected using three day weighed food records, iron status was

collected at six months of age, and growth was measured at five different time points (six weeks, and three, four, five and six months). The study found that infants who were breastfed and provided with small amounts of solids from four months of age had similar rates of growth to those who were exclusively breastfed for six months. The study also found that introducing solids from four months of age had a significant effect on infants' serum ferritin levels at six months compared to infants who were exclusively breastfed for six months (median 70 versus 44 mg/L, $P=0.02$) (Jonsdottir et al., 2012). This randomised controlled trial provides some of the first quality (gold standard) evidence of the effects of exclusive breastfeeding for four versus six months on the iron status and growth of infants in a developed country.

The reductions in exclusive breastfeeding rates seen from hospital stay after birth to six months of age, suggests it is possible that breastfeeding difficulties arise during this time as well as parents choosing not to exclusively breastfeed their infant for the entire six months currently recommended. Reasons for this may include their infant being ready for solid foods prior to six months or it may be more convenient for the caregivers to partially or artificially feed their infant.

5.2.5. Factors influencing milk-feeding practices from week two until six months

Barriers to successful breastfeeding were investigated to determine what factors influenced families' decisions to cease breastfeeding. Numerous factors were identified by participants, the main influences being: low milk supply, breastfeeding difficulties and infants appearing hungry. There were no differences in barriers between FTIs and ETIs, however, the reported number of mothers experiencing these individual barriers was low and therefore underpowered to test any significance between FTIs and ETIs. The most common reasons for ceasing breastfeeding in the GUiNZ study were also low milk supply (38%), breastfeeding difficulties (39%), and baby didn't seem satisfied by breastmilk alone (32%). Similar findings have also been reported in two separate literature reviews by Thulier and Mercer (2009) and Gerd et al. (2012). The authors established that real or perceived inadequate milk supply and breastfeeding difficulties for instance: nipple problems, latch-on, and sucking disorganisation, were the most commonly reported

causes of reduced breastfeeding duration. It would appear from these results that more breastfeeding support is required particularly around teaching mothers how to improve their milk supply and how to address breastfeeding difficulties in order to successfully establish and maintain high breastfeeding rates.

5.3. Complementary feeding practices

5.3.1. The age complementary foods were introduced to infants

The majority of infants in this study were commencing solids close to recommendations. The Ministry of Health (2012) recommends infants be exclusively breastfed until around six months of age at which time complementary feeding should commence. Complementary feeding began at a median (IQR) age of 22.8 (20.4-25.4) weeks (5.2 months) of age. Similarly, infants in the GUiNZ study were introduced to solid foods (baby rice) at a mean age of 5 months (Morton et al., 2012). Similar findings have been reported by two recent studies observational studies, Amezdroz et al. (2015) ($n=466$ infants) and Fegan et al. (2015) ($n=325$ mothers), the authors of both these studies reported the average age complementary foods were introduced was 5.2 months.

Although Amezdroz et al. (2015) and Fegan et al. (2015) results are similar to that of this present study, different methods were used to obtain their results. Amezdroz et al. (2015) collected data at four different time-points during the infant's first two years after birth (one to three, six to eight, twelve to fourteen and eighteen to twenty months) using a parent reported questionnaire whereas Fegan et al. (2015) interviewed mothers by telephone at two, four, six and twelve months of age. There is the potential that factors such as socially desirable responses and recall bias may have influenced the results of these studies.

Only a small number of infants were introduced to solids prior to 17 weeks (4 months) of age (4.9%). This is less than what was reported in the most recent report 'The Annual Update of Key Results 2014/15: New Zealand Health Survey' published by the Ministry of Health (2015a). The report found 9.1% of New Zealand infants were introduced to solids before 17 weeks of age. The results from this study are encouraging, as a recent

Australian study by Amezdroz et al. (2015) with a similar number of participants ($n=466$) found 20% of infants were introduced to solids prior to 17 weeks of age. Introducing solids before this time is not recommended as infants' renal and gastrointestinal systems are not sufficiently matured to process solid foods (ESPGHAN Committee on Nutrition, 2008). Potential health risks that may be associated with the early introduction of complementary foods include an increased risk of obesity, celiac disease and type one diabetes (Agostoni et al., 2009; Huh, Rifas-Shiman, Taveras, Oken, & Gillman, 2011). Additionally the introduction of complementary foods before three months may increase the risk of infectious morbidity (Agostoni et al., 2009).

Of interest 16.8% of FTIs and 20.7% of ETIs commenced complementary feeding after 26 weeks (six months) of age. Delaying the introduction of complementary foods after 26 weeks is also not recommended, particularly if infants are exclusively breastfed, as the volume of breastmilk consumed alone cannot meet the nutritional demands of growing infants. Therefore, this increases an infant's risk of developing nutritional deficiencies, particularly iron, which can lead to iron deficiency or iron deficiency anaemia and faltering growth (Butte et al., 2002). Again, this result differs from that reported by Amezdroz et al. (2015) who found 10% of infants in their study were introduced to solid foods after 26 weeks of age. It is important that caregivers are made aware of the risks of early and late introduction of complementary foods due to the associated potential risks involved.

5.3.2. Influences on the introduction of complementary foods

From the present study it was found that physical characteristics such as age, infant's interest in family foods and real or perceived hunger were the three main reasons influencing a caregiver's decision to introduce solid foods to their infant. Developmental readiness was also investigated in this study. Developmental readiness is an important indicator that infants are ready to start solid foods and it is recommended they be considered prior to their introduction (Palmer & Makrides, 2012). The majority of infants (92.7%) were able to hold their heads up well prior to starting solids. However a much smaller number (41.2%) reported their infants were able to sit up without assistance. Early

term infants were less likely to sit up without assistance compared to FTIs (44.1% versus 32.5%, $P=.028$). It is essential that infants have good head control and are able to sit up unsupported prior to the introduction of solids, as these abilities are required for fine motor control of hands and mouth (King, 2009).

From this study it is evident that parents are clearly looking for developmental signs that their infant is ready to commence complementary feeding. These developmental cues have the potential to be even more important for ETIs who may have initially had immature feeding skills. Although not directly assessed in this study immature feeding skills could put the infant at risk of choking if solid foods were started before the infant was ready. Therefore, it was encouraging that the majority of parents were looking for developmental cues that their infant was ready to start complementary feeding.

5.3.3. *First foods introduced to infants*

The commonly introduced first foods were vegetables and infant baby rice or cereals followed by fruit. The majority of those infants being offered baby rice or cereal were consuming store bought products, which are often fortified with iron. These results are similar to the first foods reported in the GUINZ study, which identified the most commonly consumed first foods were baby rice, vegetables and fruit (Morton et al., 2012). Over the following two weeks the majority of infants continued to consume vegetables, fruit and baby rice.

Only one infant had been introduced to fish as his/her first food and no infants had been introduced to red meat or poultry as their first food. During the first two weeks after complementary feeding had commenced a small number of infants were introduced to red meat ($n=52$), poultry ($n=48$), and fish ($n=23$). Introducing iron rich foods first, particularly red meat as this is the optimal source of haem iron, is important as it is at this time infants' iron stores are significantly depleted. One of the key reasons for introducing complementary foods at this time is to increase infants' iron stores to promote growth and development and reduce the risk of iron deficiency and the health implications that are associated with this (Lozoff et al., 2006; Ministry of Health, 2008a). Introducing meat

early, alongside iron fortified infant cereals and rice, is a key message that should be promoted, particularly as these were not commonly consumed foods by infants in this study.

After complementary feeding was established infants were consuming increased amounts of meat and meat alternatives. The mean age of the introduction of red meat was 27.5 weeks (6.3 months) and white meat was introduced at a mean age of 28.2 weeks (6.5 months). This is encouraging, as this result is younger than that reported in the GUiNZ study. Morton et al. (2012) reported seven months as the mean age meat was first consumed. It is also much younger than that reported in a recent Canadian study by Fegan et al. (2015) who found that the median age meat and meat alternatives were introduced into the diets of infants was eight months.

5.3.4. Diversity of complementary foods

After starting complementary feeding infants were exposed to a wide variety of foods from the four different food groups. The most commonly consumed food group were fruits and vegetables, followed by breads and cereals. Similar findings were identified between ETIs and FTIs.

A varied diet is important for infants, as it is the best way to ensure they have a well-balanced diet and are receiving an adequate intake of all nutrients. This reduces the risk of nutritional deficiencies and ensures optimal growth and development is maintained. Additionally, providing infants with a varied diet allows them to explore new tastes and textures and develop personal preferences (Mennella & Beauchamp, 1998).

Of interest, just over 10% of infants had been exposed to nuts and/or seeds. The GUiNZ study also found 23.2% of infants were introduced to nuts and nut butter at a median age of 8 months (Morton et al., 2012). The New Zealand guidelines recommendation is to delay providing infants and children with some hard foods, such as large whole nuts and seeds, until they are at least five years of age as they are a choking hazard (Ministry of Health, 2008a). There is, however, evidence to suggest introducing nut butter between

the age of six to eleven months may be beneficial at preventing nut allergies (Du Toit et al., 2015). Investigating the types of nuts and seeds introduced to infants was beyond the scope of this study.

5.3.5. Infant feeding styles

This study looked at the different methods of introducing complementary foods to infants. Eleven percent of infants were being introduced to foods by an infant feeding style known as baby-led weaning. Slightly more FTIs (11.5%) were introduced to baby-led weaning compared to ETIs (8.8%). Baby-led weaning is where infants receive 'whole' (or table) foods when they are first introduced to solid foods (Ministry of Health, 2014). In New Zealand baby-led weaning is currently not recommended due to safety concerns. For instance, baby-led weaning may increase the risk of choking on foods and there is also the potential risk that this method of feeding may lead to faltering growth and reduced iron stores (Ministry of Health, 2014). Instead, mothers are advised to commence complementary feeding with puréed foods, then progress through the different food textures (mashed, chopped and family foods) from seven months of age onwards. If parents and caregivers want their infants to receive 'whole' foods, it may be more appropriate to do this alongside spoon-feeding to ensure energy and nutritional requirements are met.

5.3.6. Support offered to mothers

It is important to take into consideration how well supported mothers are by those around them, as well supported mothers may be more likely to feed their infants to recommended guidelines. The majority of mothers (58%) felt they were well supported. However, 20.3% felt they required additional support when introducing complementary foods. Mothers in this study were not directly asked what types of support they required in regards to complementary feeding; however it is evident that more support is needed regarding the types of first foods introduced to infants and perhaps the quantities required.

6.0. Conclusion

6.1. Summary

This study was designed to provide insight into the feeding practices of early term infants (ETIs) and full term infants (FTIs) living in New Zealand from birth until six months of age, and investigate the factors that influence these feeding practices. A total of 438 participants were recruited from across the country between April 2015 and November 2015. Retrospective information was collected on the feeding practices of infants from birth until six months.

The primary objective of this study was to compare the feeding practices of ETIs and FTIs from birth until six months of age. In this study, infants born early term experienced significantly lower rates of exclusive breastfeeding over the first 22 weeks after birth compared to FTIs. By week 26, however, similar breastfeeding rates were seen between the two groups. No differences were seen between the two groups in regards to the timing of the introduction of complementary foods and the types of complementary foods offered. Consistent with the hypothesis, this study found ETIs experienced reduced exclusive breastfeeding rates compared to FTIs over the first six months after birth.

The second objective was to explore the feeding practices of infants during the first week after birth. This study found that this population of infants experienced lower rates of breastfeeding over the first week after birth compared to the rates reported by other New Zealand studies. This present study also found ETIs were significantly less likely to breastfeed during their hospital stay following birth and during the first week after birth compared to FTIs. Consistent with the hypothesis, this study found ETIs experienced lower exclusive breastfeeding rates compared to FTIs during the first week after birth.

The third objective was to describe the feeding practices of infants from birth until six months of age in relation to national infant feeding guidelines. From birth until six months there was a significant decrease in the number of infants exclusively breastfeeding from 82.6% during their hospital stay to 5% by six months. This shows that the weeks and months following discharge from hospital is a vulnerable period for

breastfeeding maintenance. A similar rate of breastfeeding decline was seen between ETIs and FTIs. Infants in this study began complementary feeding at a mean age of 22.8 weeks. First foods consumed by numerous infants in this study population were relatively low in iron. From six months onwards infants were exposed to a wider variety of foods. In line with the study hypothesis, this study found infants are not being fed in accordance with current national infant feeding guidelines.

The final objective was to identify factors that may influence the feeding practices of early term and late term infants. Early term infants experienced significantly more breastfeeding difficulties in the first week after birth, however, ETIs experienced similar difficulties as FTIs from two weeks onwards. Early term infants were significantly more likely to consume infant formula due to medical reasons and personal choice compared to FTIs. Both ETIs and FTIs ceased breastfeeding due to low milk supply, breastfeeding difficulties, and their infant appearing hungry. This is important for healthcare professionals to be aware of, as providing greater support to mothers concerning these issues may help to maintain higher rates of breastfeeding in the future.

6.2. Conclusion

The evidence produced by this study suggests that there is a need for New Zealand to adopt the definitions of 'term birth'. In line with recommendations produced by 'The American College of Obstetricians and Gynecologists' and 'The Society for Maternal-Fetal Medicine' New Zealand District Health Boards (DHB's), healthcare providers and stakeholders, should consider subcategorising 'term births' into early term (37 weeks and 0 days to 38 weeks and 6 days), full term (39 weeks and 0 days to 40 weeks and 6 days), as being born early term is associated with suboptimal health outcomes (Spong, 2013).

The number of elective early term caesarean deliveries is of concern, as ETIs are at greater risk of short- and long-term morbidities. The implementation of policies aimed at reducing the number of elective births before 39 weeks gestation, such as those in the United States, are recommended to address the number of early elective caesarean deliveries prior to 39 weeks gestation. The implementation of policies such as these,

which include restricting the number of unnecessary early elective births, has been shown to reduce the number of elective early deliveries. Health care providers and expectant parents need to be made aware of the potential health risks associated with early elective deliveries, particularly those that are non-medically indicated.

This study also demonstrates that ETIs are at an increased risk of reduced breastfeeding duration during the first six months after birth, therefore reducing the health benefits provided to these infants by breastmilk. Healthcare professionals should be aware that infants born early term are less likely to successfully breastfeed than those born later than 39 weeks gestation. Mothers of infants classified as early term may require more support in order to maintain higher breastfeeding rates.

The majority of infants in this study were not breastfeeding in line with current international and national guidelines, particularly once discharged into the community. Therefore, it would appear that greater support is needed for mothers of both FTIs and ETIs post hospital discharge, in order to improve exclusive breastfeeding rates. Public health messages regarding the importance of breastfeeding and greater access to breastfeeding support may aid in improving breastfeeding durations. However, those who do not wish to breastfeed their infant, for whatever reason, should feel supported in their decision to do so.

Additionally this study shows that more health initiatives are required to promote the introduction of appropriate first foods. A large number of infants in this study were not exposed to iron rich first foods. No differences were seen in the consumption of iron rich first foods between ETIs and FTIs. Iron is an essential nutrient for infants' growth and development. For this reason the importance of iron rich foods, particularly those rich in haem iron should be strongly promoted as first foods for infants.

6.3. Strengths

Currently limited data exists on the breastfeeding rates of ETIs both nationally and internationally. This study provides valuable insight into the feeding practices of ETIs

from birth until six months of age. It also provides information on the feeding practices of New Zealand infants.

One of the recommendations from the National Maternity Monitoring Group (2014) was that the rates of induction of labour and caesarean sections should be monitored carefully by DHBs. This current study fits within this directive, providing further information on the number of early term births in New Zealand. This study also supports the need for DHBs and stakeholders to use consistent terminology when defining 'term' births.

One strength of this present study was the administration of the questionnaire via the online survey. Allowing participants to complete the survey in this manner enabled them to complete the questionnaire at their own convenience, reducing the burden of being involved in the study. It also allowed the researchers to reach out to potential participants from across the country, therefore increasing the number of participants eligible to partake in the study. It additionally provided a safe platform for participants to anonymously complete the questionnaire free of judgement, reducing potential bias.

Another advantage to this study is that those who participated in the study had infants starting complementary foods around the time the questionnaire was administered. As a result, food data that were collected allowed the researchers to determine the exact types and timing of foods introduced to infants with limited recall bias from participants involved.

A further strength was the excellent response rate during the second phase of the study. This study has demonstrated that the use of a simple instrument such as an online questionnaire is an effective tool for investigating infant feeding issues and practices. It should, however, be noted that this questionnaire was not sent to all mothers of infants aged between five to six months in New Zealand, therefore this study does have issues with sampling bias.

The ability of this study to collaborate with senior paediatric staff members at Auckland City Hospital is another strength. This collaboration allows for the dissemination of results to health professionals who deal directly with ETIs and FTIs giving this study the ability to influence further hospital policies and procedures.

6.4. Limitations

Several limitations have been identified regarding this present study. First, a prospective study design would have produced more robust results compared to the retrospective design this study employed. Prospective studies often have fewer potential sources of bias and confounding factors compared to retrospective studies (Euser, Zoccali, Jager, & Dekker, 2009). However, due to time restrictions placed on the researchers to complete this study, a prospective study design was not possible.

Second, ethical provisions allowing only indirect contact with potential participants hindered this study. Initially, the present study was to explore the feeding practices of infants of all gestational ages discharged from Auckland City Hospital, with the aim of determining if current hospital protocols were sufficient to encourage and support optimal feeding practices post discharge. However this did not transpire. 841 potential participants were identified and 770 were contacted by means of a letter of invite, 103 (13.4%) agreed to be involved in the study. Of these, 87 (11.3% of the total sample contacted) completed the questionnaire. One of the key reasons for such an unfortunate participation rate was due to ethical requirements not allowing the research team to contact potential participants by other means than the initial letter of invite. Research (Sheehan, 2001) has demonstrated that pre-notification of a study and follow up contact with potential participants successfully yields an increased response rate. Regrettably due to recruitment restrictions these strategies were unable to be implemented. Since this recruitment strategy failed to obtain the required sample size another approach to recruitment was necessary, therefore phase two was implemented.

Third, the cohort consisted of mainly FTIs and infants who were identified as New Zealand European. Time restrictions placed on the study hindered the researchers' ability

to target infants born early term and those who identified as non-European. Running the study over a longer time period may have yielded a higher number of ETIs recruited and obtained a broader ethnic mix.

Fourth, breastfeeding status and the introduction of complementary foods were measured using a self-reported questionnaire, therefore introducing potential reporting bias. The questionnaire was developed based on the Ministry of Health's nutrition guidelines for healthy infants and toddlers and previous national and international studies. This questionnaire is currently in the process of being validated. There is also the potential for recall bias, particularly in regards to feeding in the first few days and weeks after birth as the questionnaire was administered when infants were aged between six to nine months. However experiences in other developed countries have demonstrated that the accuracy of parent recall in the first six months is acceptable (Li, Scanlon, & Serdula, 2005; Natland, Andersen, Nilsen, Forsmo, & Jacobsen, 2012).

Fifth, the Ministry of Health recommends infants begin solids at around six months of age. This recommendation is somewhat unclear, as it does not provide an age range at which infants are recommended to start solids; therefore it is left to the discretion of caregivers and health care professionals to interpret this recommendation. This makes it difficult to accurately report whether infants are starting solid foods at an appropriate age, particularly when some infants may safely be ready for solid foods before or after six months.

Finally this study did not assess the social and physical characteristics of the mothers involved in the study such as socio-economic status, education level and maternal BMI. Studies have demonstrated women with advanced education, higher socio-economic status and having a healthy BMI (18.5-24.9 kg/m²) are more likely to follow infant feeding recommendations compared to those who do not. Future research into the social and physical characteristics of New Zealand mothers and their influence on infant feeding may help determine who might benefit the most from health interventions that encourage appropriate infant feeding practices.

6.5. Recommendations for further research

1. This is one of the first studies in New Zealand to investigate the feeding practices of ETIs and FTIs at six months of age. Additional research of a similar nature is required to validate the findings from this study and add to the limited body of research regarding this subject matter.
2. Further research should investigate the iron status of ETIs at birth in comparison to infants born greater than 39 weeks gestation. It should also examine the frequency of iron rich foods provided to infants.
3. Further research in New Zealand should assess the effects of implementing policies and procedures for the scheduling of elective deliveries prior to 39 weeks gestation.
4. Further research should investigate whether ethnic disparities exist between ETIs and FTIs.
5. Further research should examine whether additional breastfeeding support provided to mothers improves exclusive breastfeeding rates.

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Appendices

Appendix A: Steps to successful breastfeeding

Every facility providing maternity services and care for newborn infants should:

1. Have a written breastfeeding policy that is routinely communicated to all health care staff.
2. Train all health care staff in skills necessary to implement this policy.
3. Inform all pregnant women about the benefits and management of breastfeeding.
4. Help mothers initiate breastfeeding within half an hour of birth.
5. Show mothers how to breastfeed, and how to maintain lactation even if they should be separated from their infants.
6. Give newborn infants no food or drink other than breast milk, unless medically indicated.
7. Practise rooming-in - that is, allow mothers and infants to remain together - 24 hours a day.
8. Encourage breastfeeding on demand.
9. Give no artificial teats or pacifiers (also called dummies or soothers) to breastfeeding infants.
10. Foster the establishment of breastfeeding support groups and refer mothers to them on discharge from the hospital or clinic.

Source: Protecting, Promoting and Supporting Breastfeeding: The Special Role of Maternity Services, a joint WHO/UNICEF statement published by the World Health Organization.

Appendix B: HDEC study approval letter



Health and Disability Ethics Committees

Ministry of Health
Freyberg Building
20 Aitken Street
PO Box 5013
Wellington
6011

0800 4 ETHICS
hdec@mh.govt.nz

10 June 2015

Dr Cathryn Conlon
School of Food & Nutrition
Massey University, Albany campus
Private Bag 102 904 North Shore Mail centre
Auckland 0745

Dear Dr Conlon

Re: Ethics ref:	15/NTB/101
Study title:	Parental reporting of feeding practices of infants after discharge from Newborn services at ADHB: An observational study

I am pleased to advise that this application has been *approved* by the Northern B Health and Disability Ethics Committee. This decision was made through the HDEC-Expedited Review pathway.

Conditions of HDEC approval

HDEC approval for this study is subject to the following conditions being met prior to the commencement of the study in New Zealand. It is your responsibility, and that of the study's sponsor, to ensure that these conditions are met. No further review by the Northern B Health and Disability Ethics Committee is required.

Standard conditions:

1. Before the study commences at *any* locality in New Zealand, all relevant regulatory approvals must be obtained.
2. Before the study commences at a *given* locality in New Zealand, it must be authorised by that locality in Online Forms. Locality authorisation confirms that the locality is suitable for the safe and effective conduct of the study, and that local research governance issues have been addressed.

Non-standard conditions:

- Consent Form: Text needs to be included acknowledging the baby as a participant and the parent is consenting to their baby (as well as themselves) participating in the study. Please amend all relevant text from 'me, my, I' to 'me and my baby'.

Non-standard conditions must be completed before commencing your study. Non-standard conditions do not need to be submitted to or reviewed by HDEC before commencing your study. Do not submit non-standard conditions as a post approval form (PAF).

For information on non-standard conditions please see section 128 and 129 of the Standard Operating Procedures at <http://ethics.health.govt.nz/home>.

After HDEC review

Please refer to the *Standard Operating Procedures for Health and Disability Ethics Committees* (available on www.ethics.health.govt.nz) for HDEC requirements relating to amendments and other post-approval processes.

Your next progress report is due by 9 June 2016.

Participant access to ACC

The Northern B Health and Disability Ethics Committee is satisfied that your study is not a clinical trial that is to be conducted principally for the benefit of the manufacturer or distributor of the medicine or item being trialled. Participants injured as a result of treatment received as part of your study may therefore be eligible for publicly-funded compensation through the Accident Compensation Corporation (ACC).

Please don't hesitate to contact the HDEC secretariat for further information. We wish you all the best for your study.

Yours sincerely,



Raewyn Sporle
Chairperson
Northern B Health and Disability Ethics Committee

Encl: appendix A: documents submitted
appendix B: statement of compliance and list of members

Appendix C: HDEC revised study application approval letter



Health and Disability Ethics Committees

Ministry of Health
Freyberg Building
20 Aitken Street
PO Box 5013
Wellington
6011

0800 4 ETHICS
hdec@moh.govt.nz

16 September 2015

Dr Cathryn Conlon
School of Food & Nutrition
Massey University, Albany campus
Private bag 102 904 North Shore Mail centre
Auckland 0745

Dear Dr Conlon

Re:	Ethics ref:	15/NTB/101/AM01
	Study title:	Parental reporting of feeding practices of infants after discharge from Newborn services at ADHB: An observational study

I am pleased to advise that this amendment has been *approved* by the Northern B Health and Disability Ethics Committee. This decision was made through the HDEC Expedited Review pathway.

Please don't hesitate to contact the HDEC secretariat for further information. We wish you all the best for your study.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'R. Sporle'.

Raewyn Sporle
Chairperson
Northern B Health and Disability Ethics Committee

Encl: appendix A: documents submitted
appendix B: statement of compliance and list of members

Appendix D: Auckland City Hospital study approved document



10th June 2015

Cathryn Conlon
School of Food and Nutrition
Massey University
Albany Campus

Dear Cath

RE: Research project A+ 6696 (15/NTB/101) - Parental reporting of feeding practices of infants after discharge from Newborn services at ADHB: An observational study

The Auckland DHB Research Review Committee (ADHB-RRC) would like to thank you for the opportunity to review your study and has given approval for your research project.

Your Institutional approval is dependant on the Research Office having up-to-date information and documentation relating to your research and being kept informed of any changes to your study. It is your responsibility to ensure you have kept the Research Office up to date and have the appropriate approvals. ADHB approval may be withdrawn for your study if you do not keep the Research Office informed of the following:

- Any amendment to study documentation
- Any change to the ethical approval of the study
- Study completion, suspension or cancellation

More detailed information is included on the following page. If you have any questions please do not hesitate to contact the Research Office.

Yours sincerely

On behalf of the ADHB Research Review Committee
Dr Mary-Anne Woodnorth
Manager, Research
ADHB

c.c. Malcolm Battin, Chris McKinlay

Research Office
Level 14, Support Bldg
Auckland City Hospital
PB 92024, Grafton, Auckland
Phone: 64 9 307 4949 Extn. 23854
Fax: 64 9 307 8913
Email: mwoodnorth@adhb.govt.nz
Website: www.adhb.govt.nz/ResearchOffice

Institutional Approval

.../continued next page

Appendix E: Letter of invite (phase one)



Service: NUTRITION
Phone: 09- 379 7440
Ext: 23351
Email: bcormack@adhb.govt.nz
Address: Level 8
Support Building
Auckland City Hospital
Private Bag 92024
Auckland 1142

Parental reporting of feeding practices of infants after discharge from Newborn services at Auckland City Hospital: An observational study

Dear Parent or Caregiver

We are writing to you to invite you to take part in a research study to look at how babies were fed after discharge from hospital. Parents of newborn babies discharged from Auckland City Hospital are being invited to take part. The study will involve completing questionnaires about how you have fed your baby at home. Please find enclosed an information sheet about the study, a consent form and contact details for the researchers who are doing this study. Taking part in this study is entirely optional.

A student dietitian is undertaking this research as part of her training and the research is being run by a team of people who are all interested in finding out more about how babies are fed. This includes a nutrition researcher from Massey University in Auckland (Dr Cath Conlon), Dr Chris McKinlay (Consultant Paediatrician at Auckland City Hospital) and me, Barbara Cormack (Paediatric Dietitian at Auckland City Hospital and clinical supervisor for the student dietitian). Taking part in this study will make no difference to any health care your baby requires now or in the future. If you think you might be interested in this study, please complete the contact details sheet and return using the free post self-addressed envelope supplied. If you would like more information please email, text or telephone using the contact details provided. Thank you for considering taking part in this research.

Kind regards

Barbara

A handwritten signature in black ink that reads 'Barbara Cormack'.

Barbara Cormack
Paediatric Dietitian



MASSEY UNIVERSITY
COLLEGE OF HEALTH
TE KURA HAUORA TANGATA

Parental reporting of infant feeding practices

Participant Information Sheet

You are invited to take part in a study on feeding your baby. Whether or not you take part is your choice. If you don't want to take part, you don't have to give a reason, and it won't affect the care you receive. If you do want to take part now, but change your mind later, you can pull out of the study at any time.

This Participant Information Sheet will help you decide if you'd like to take part. It sets out why we are doing the study, what your participation would involve, what the benefits and risks to you might be, and what would happen after the study ends. We will go through this information with you and answer any questions you may have. Before you decide whether to take part you may want to talk about the study with other people, such as family, whānau, friends, or healthcare providers. Feel free to do this.

If you agree to take part in this study, you will be asked to sign the Consent Form. You will be given a copy of both the Participant Information Sheet and the Consent Form to keep.

This document is 4 pages long. Please make sure you have read and understood all the pages.

WHAT IS THE PURPOSE OF THE STUDY?

We would like to find out more about how parents feed their baby after they have been discharged from hospital. Going home with a new baby is a stressful time for parents and this can be even more stressful if your baby was born preterm (born earlier than expected before 37 weeks of gestation). From this study we hope to find out if parents of preterm and term babies (born at over 37 weeks of gestation) are given enough information and support for feeding their baby at home.

Our study will look at feeding practices of babies at 6 and 12 months of age (if your baby is preterm we would use 6 and 12 months corrected age). The information that we will collect will be your report of how you have fed your baby and we will collect this information using questionnaires. You will have the choice of completing the questionnaire online or a hard copy (with a prepaid envelope provided). Researchers will be available over the telephone or via email to answer any questions you have about the study or completing the questionnaires.

The researchers for this study all have expertise in feeding babies and nutrition. The research team is a collaboration of health professionals from Auckland District Health Board, Auckland University and Massey University. There is an MSc Nutrition and Dietetic student who is undertaking part of this research as a project for her qualification. All of the researchers are providing their time for this study without funding and as the data is collected and processed by the research team there is no funding associated with the study.

The Northern B Health Disability Ethics Committee has given ethical approval (No.15/NTB/101) for this study (expedited review process) and the Auckland District Health Board Research Review Committee have provided permission for this study to be conducted. The Clinical Director of Newborn Services, Auckland City Hospital has also given permission for this study to be carried out.

WHAT WILL MY PARTICIPATION IN THE STUDY INVOLVE?

You have been sent this information about the study because you have a baby. Parents of all babies including babies born early (before 37 weeks' of gestation) and term babies (born over 37 weeks' of gestation) are being invited to take part in this study.

Taking part in the study will involve completing a questionnaire about you and 2 questionnaires about feeding your baby. One will be completed when your baby is 6 months old and one when they are 12 months old. The questionnaire about you will take about 5 minutes to complete and each feeding questionnaire will take 10-15 minutes to complete. The total amount of time involved will be 30-35 minutes evenly split over 2 occasions. Taking part in the study will make no difference to any health care you receive whilst you are part of the study.

The study will finish when you have completed the questionnaire when your baby is 12 months of age. If your baby is preterm this will be 12 months corrected age.

If you agree to take part in the study you will be contacted by a researcher (via email or telephone) and any questions or concerns that you have about the study will be answered. You will then be asked to sign a consent form. Once you have consented to take part we will email you an online link to the questionnaire about you and feeding your baby at 6 months of age. If you would prefer a hard copy of the questionnaire we will send this to you with a prepaid envelope. When your baby is 12 months of age we will send you another online link (or hard copy) to the second feeding questionnaire.

We will also ask you a few questions about how you fed your baby immediately after they were born and whether you had any problems feeding your baby. All of the data which is collected from you will be confidential and data will not be identifiable to individuals.

WHAT ARE THE POSSIBLE BENEFITS AND RISKS OF THIS STUDY?

There are no apparent risks associated with this study. All of the data that is collected will be about feeding your baby and neither you nor your baby will be identifiable within the results of the study. Although there is no direct benefit of taking part in the study you will be helping us to identify whether parents receive enough information and support for feeding their baby after discharge from hospital. This could benefit parents and babies in the future.

WHO PAYS FOR THE STUDY?

Participants will not incur any costs from taking part in the study.

FURTHER ADVICE

If you have any concerns about feeding your baby please consult with your general medical practitioner or Well Child/Tamariki Ora health provider.

WHAT ARE MY RIGHTS?

Taking part in this study is entirely voluntary and you are free to decline to participate, or to withdraw from the research at any time prior data being stored and de-identified at the end of the study, without experiencing any disadvantage. You have the right to access any of the information which has been collected as part of the study. The researchers have taken all possible steps to ensure your privacy and confidentiality.

WHAT HAPPENS AFTER THE STUDY OR IF I CHANGE MY MIND?

When we have finished data collection and sent all parents a copy of the findings from the study we safely and securely destroy all contact details. Study data will only be identified by a unique study identification code and safely stored for a duration of 16 years. The principle investigator for the study Dr Cath Conlon will be responsible for the safe storage of study data. None of the data will be used for any purpose other than what is described within this information sheet.**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:

Dr Cath Conlon (Principle Investigator)

Senior Lecturer

School of Food and Nutrition

Massey University

Albany Campus

Private Bag 102 904

North Shore Mail Centre

Auckland

New Zealand

Work Telephone: 09 414 0800 ext 43658

Out of hour's telephone: 021 173 0428

Email: c.conlon@massey.ac.nz

If you would like help with completing the questionnaire please contact:

Victoria Arliss

Dietetic Masters Students from Massey University

Massey University

Albany Campus

Private Bag 102 904

North Shore Mail Centre

Auckland

New Zealand

Email: varliss@ihug.co.nz

Ph: 0211 429 038

If you want to talk to someone who isn't involved with the study, you can contact an independent health and disability advocate on:

Phone: 0800 555 050

Fax: 0800 2 SUPPORT (0800 2787 7678)

Email: advocacy@hdc.org.nz

If you require Māori cultural support talk to your whānau in the first instance. Alternatively you may contact the administrator for He Kamaka Waiora (Māori Health Team) by telephoning 09 486 8324 ext 2324

You can also contact the health and disability ethics committee (HDEC) that approved this study on:

Phone: 0800 4 ETHICS

Email: hdecs@moh.govt.nz

Appendix G: Consent form (phase one)



Consent Form

Parental reporting of infant feeding practices study

English	I wish to have an interpreter	Yes	No
Maori	E hiahia ana ahau ki tetahi kaiwhakamaori / kaiwhaka pakeha korero	Ae	Kao
Cook Island	Ka inangaro au i tetai tangata uri reo	Ae	Kare
Fijian	Au gadreva me dua e vakadewa vosa vei au	Io	Sega
Niuean	Fia manako au ke fakaaoga e taha tagata fakahokohoko kupu	E	Nakai
Samoaan	Ou te mana'o ia i ai se fa'amatala upu	loe	Leai
Tokelaun	Ko au e fofou ki he tino ke fakaliliu te gagana Peletania ki na gagana o na motu o te Pahefika	loe	Leai
Tongan	Oku ou fiema'u ha fakatonulea	Io	Ikai

- *I have read and I understand the information sheet dated 22/6/2015 for the study Parental reporting of infant feeding practices and I have had the opportunity to discuss this project. I am satisfied with the answers I have been given.*
- *I have had the opportunity to use family / whanau support or a friend to help me ask questions and understand the project.*
- *I have had time to consider whether myself and my baby should take part in this project.*
- *I understand that taking part in this project is voluntary (my choice for myself and my baby) and that we can stop taking part at any time and this will in no way affect our continuing or future health care.*
- *I understand that our participation in this project is confidential and that no material which could identify me or my baby will be used in any reports.*
- *I know who to contact if I have questions about the project in general.*
- *I consent to medical information being collected from the medical records made during my baby's hospital admission.*

Declaration by participant:

I hereby consent for myself and my baby to take part in this study.

Participant's name: _____

Baby's name: _____

Signature: _____

Date: _____

Appendix H: Contact details form (phase one)



Parental reporting of feeding practices of infants

Research study

Contact Details Form

Please note these contact details are required so that we can contact you about the study. Taking part in the study is voluntary (your choice) Contact details will only be retained if you agreed to take part in the study and will be destroyed in confidential waste when the study is finished or if you withdraw from taking part.

Your name:

Home phone number:

.....

Mobile phone number:

.....(optional)

Email address:

Address:.....

.....

.....

Please indicate below how you would like to complete the questionnaire (tick all that apply):

- Please email me the online link to the questionnaire
- Please send me a hard copy of the questionnaire
- I would like a researcher to contact me
- I will fill in the online questionnaire

RESEARCH STUDY

How Babies Are Fed From Birth

Help us find out how babies are fed from birth until 12 months of age

Going home with a new baby is a stressful time for parents and this can be even more stressful if your baby was born preterm (born before 37 weeks of gestation).

From this study we hope to find out if parents of preterm and term babies (born at over 37 weeks of gestation) are given enough information and support for feeding their babies at home.

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

Dr Cath Conlon (Principle Investigator)
Work Telephone: 09 414 0800 ext 43658
Out of hour's telephone: 021 173 0428
Email: c.conlon@massey.ac.nz

If you would like help with completing the questionnaire please contact:

Victoria Arliss
Email: varliss@ihug.co.nz
Ph: 0211 429 038

If you need Māori cultural support talk to your whānau in the first instance. Alternatively you may contact the administrator for He Kamaka Waiora (Māori Health Team) by telephoning 09 486 8324 ext 2324.

Study Approval
The research has been approved by the Health Disability Ethics Committee (No. 15/N7B/101) and ADHB Research Office (A+6696).

MASSEY UNIVERSITY
HE KAMAKA WAIORA
UNIVERSITY OF NEW ZEALAND

AUCKLAND
DISEASE CONTROL
CENTRE



What is the reason for this study?

We would like to find out more about how parents feed their babies after they have been discharged from hospital. Our study will look at feeding practices of babies at 6 and 12 months of age (if your baby is preterm we would use 6 and 12 months corrected age). The link to the first questionnaire can be found on the back of this pamphlet.

Who could join the study?

We are inviting all mothers whose baby were born or admitted to National Women's Health at Auckland City Hospital to take part.

Do I have to take part?

No, it's your choice. If you don't want to take part, you don't have to give a reason.

What will happen to the information you provide?

You have been given a unique number which is located on this pamphlet. This number is the only way to identify your involvement.

What will we ask you to do?

If you decide to take part we will ask you to complete 2 questionnaires. The 1st questionnaire asks about how your baby was fed at 6 months and the 2nd questionnaire asks about feeding at 12 months of age. You will be able to complete these questionnaires online or a hard copy can be provided. Researchers will be available over the telephone or via email to answer any questions you have about the study or completing the questionnaires.

We would also like to collect some information about you and your baby while you were in hospital. On the consent form for this study you will be asked specifically whether we can access medical records to find out data on factors we think may affect later feeding. All of the data which is collected from your medical records will be confidential and data will not be identifiable to individuals.



What are the possible benefits and risks of the study?

There are no risks associated with this study. All of the data collected will be about feeding your baby and neither you nor your baby will be identifiable within the results of the study. Although there is no direct benefit of taking part in the study you will be helping us to identify whether parents receive enough information and support for feeding their babies after discharge from hospital. This could benefit parents and babies in the future.

The link to the questionnaire can be found at:
www.surveymonkey.com/r/howbabyfeeds

YOUR STUDY NUMBER IS

More information about the study can be found in the information sheet provided.

Appendix J: Letter to Reach Me



To whom it may concern

Massey University is currently conducting a research study titled 'Parental reporting of infant feeding practices in New Zealand' which is an observational study looking at the feeding practices of infants in New Zealand. We are carrying out this study, as we would like to find out more about how parents feed their babies after they have been discharged from hospital. Our study will look at feeding practices of babies at 6 and 12 months of age (if baby is preterm we would use 6 and 12 months corrected age). From this study we hope to find out if parents of preterm and term babies are given enough information and support for feeding their baby at home. We are currently looking for individuals who may be interested in participating in this study.

The study involves completing two online questionnaires about how babies are being fed, one at 6 months of age the other at 12 months. Those eligible to participate in the study are caregivers of infants who were born either preterm or term and are currently between 5-7 months of age, living in New Zealand in a home environment. The questionnaire takes approximately 20-30 minutes to complete and covers a wide range of infant feeding and general health questions.

There are no risks associated with this study. All of the data collected will be about feeding baby and neither the mother nor baby will be identifiable within the results of the study. Although there is no direct benefit of taking part in the study participants will be helping us to identify whether parents receive enough information and support for feeding their babies after discharge from hospital. This could benefit parents and babies in the future.

We would like to advertise our research study through your facebook webpage to potential participants. If this is something you feel happy to help with I can send you the small advert we'd like to post. It is just a short blurb about the study and a link to the questionnaire.

If you have further questions or would like more information please do not hesitate to contact me.

Kind regards
Victori Arliss
Nutrition and Dietetic Masters Student, Massey University

Dr Cath Conlon
Senior Lecturer in Human Nutrition
School of Food & Nutrition
College of Health
Massey University, Albany Campus,
Private Bag 102904, North Shore City, 0745, Auckland, New Zealand
Tel +64 9 414 0800 ext 43658

Appendix K: Six month infant feeding questionnaire

How babies feed from birth until 6 months of age

1. STUDY INFORMATION

We are recruiting ALL parents and caregivers of babies aged 6-9 months who are currently living in New Zealand. This questionnaire asks about how your baby has been fed from birth to 6 months. There are no "right" or "wrong" answers. If you have more than one baby enrolled in this study, please fill out a separate questionnaire for each baby. All of the data collected is anonymous and your answers will be held in strict confidence. For more information about the study [click here](#)

*** 1. Do you consent to taking part in this study?**

- Yes
 No

*** 2. Are you currently living in New Zealand? To take part in this study you must be living in New Zealand.**

- Yes
 No

3. Where in New Zealand was your baby born?

- | | | |
|-------------------------------------|-----------------------------------|------------------------------------|
| <input type="radio"/> Northland | <input type="radio"/> Taranaki | <input type="radio"/> West Coast |
| <input type="radio"/> Auckland | <input type="radio"/> Hawke's Bay | <input type="radio"/> Christchurch |
| <input type="radio"/> Coromandel | <input type="radio"/> Wanganui | <input type="radio"/> Canterbury |
| <input type="radio"/> Bay of Plenty | <input type="radio"/> Manawatu | <input type="radio"/> Queenstown |
| <input type="radio"/> Waikato | <input type="radio"/> Wairarapa | <input type="radio"/> Otago |
| <input type="radio"/> Rotorua | <input type="radio"/> Wellington | <input type="radio"/> Southland |
| <input type="radio"/> Eastland | <input type="radio"/> Nelson | |
| <input type="radio"/> Taupo | <input type="radio"/> Marlborough | |

Other (please specify)

*** 4. What is your baby's birth date?**

DD MM YYYY
Birth date / /

5. What is the gender of your baby

- Male
 Female

*** 6. What gestational age was your baby born at? (e.g. 39 weeks and 4 days)**

How babies feed from birth until 6 months of age

*7. How was your baby delivered?

- Normal delivery
- Normal delivery – induced
- Elective cesarean section
- Emergency cesarean section
- Ventose
- Forceps

*8. How was your baby fed whilst he/she was in hospital?

- Breast milk only
- Infant formula only
- Combination of milk and infant formula
- Nutrition through an intravenous line

If your baby received nutrition through an intravenous line, can you remember how long for?

*9. How was your baby fed in the first week after they were born (tick all that apply)?

- Breast
- Feeding tube
- Cup or syringe
- Nutrition through an IV Line
- Bottle

*10. What milk did your baby receive in the first week (tick one)?

- Breast milk only
- Infant formula only
- Combination of breast and formula milk

*11. If baby received formula milk in the first week, what were the main reasons (tick all that apply)?

- Not applicable - my baby did not receive formula during his/her first week of life
- Personal choice
- Low blood sugar
- Baby losing weight
- Difficulty breast feeding
- Recommended by a health professional
- Jaundice
- Other (please specify)

2. FEEDING FROM 2 WEEKS TO 6 MONTHS

How babies feed from birth until 6 months of age

***1. Please indicate all milk and fluids that baby received at each of the following ages (tick all that apply):**

	2 weeks	1 month	2 months	4 months	5 months	6 months
Breast milk (from breast or expressed)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Infant formula all types	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Cow's milk from supermarket	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Juice	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tea	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other drink	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Other formula/drink (please specify)

***2. Has baby had infant formula at any stage?**

Yes

No

3. INFANT FORMULA

***1. What were the main reasons for starting formula (tick all that apply)?**

Personal choice

I didn't have enough milk

Recommended by family / friend

Going back to work

Baby self-weaned from breast

Recommended by a health professional

Unable to express at work

Baby seemed hungry

Prefer not to answer

Breastfeeding was difficult

Concerned about baby's growth

Other (please describe)

***2. Did you breastfeed at any stage?**

Yes

No

4. BREASTFEEDING

***1. Are you still breastfeeding?**

Yes

No

How babies feed from birth until 6 months of age

5. A FEW MORE QUESTIONS ABOUT FEEDING

*1. What were the main reasons for stopping breast feeding (tick all that apply)?

- | | |
|--|---|
| <input type="checkbox"/> Personal choice | <input type="checkbox"/> Concerned about baby's growth |
| <input type="checkbox"/> Going back to work | <input type="checkbox"/> Recommended by family / friend |
| <input type="checkbox"/> Unable to express at work | <input type="checkbox"/> Recommended by a health professional |
| <input type="checkbox"/> Breastfeeding was difficult | <input type="checkbox"/> Found out I was pregnant |
| <input type="checkbox"/> I didn't have enough milk | <input type="checkbox"/> Prefer not to answer |
| <input type="checkbox"/> Baby seemed hungry | |
| <input type="checkbox"/> Other (please describe) | |

*2. Please indicate all milk and fluids that your baby has drunk in the last 4 days:

	Has baby drunk this in the last 4 days?	How many days in the last 4 days?	How many times per day?
Breast milk (from breast or expressed)	<input type="text"/>	<input type="text"/>	<input type="text"/>
Expressed breast milk	<input type="text"/>	<input type="text"/>	<input type="text"/>
Infant formula all types	<input type="text"/>	<input type="text"/>	<input type="text"/>
Normal cow's milk	<input type="text"/>	<input type="text"/>	<input type="text"/>
Water	<input type="text"/>	<input type="text"/>	<input type="text"/>
Juice	<input type="text"/>	<input type="text"/>	<input type="text"/>
Soft drink	<input type="text"/>	<input type="text"/>	<input type="text"/>
Tea	<input type="text"/>	<input type="text"/>	<input type="text"/>
Other milk (not cow's milk or infant formula)	<input type="text"/>	<input type="text"/>	<input type="text"/>

*3. Has your baby started solid food?

- Yes No (If your baby hasn't started solids we will send you these questions at a later date)

If 'YES' what was the date your baby started eating solid foods (DD/MM/YYYY)?

6. STARTING SOLIDS

How babies feed from birth until 6 months of age

*1. What were the reasons for starting your baby on solids (tick all that apply)?

- | | |
|---|---|
| <input type="checkbox"/> Baby was old enough | <input type="checkbox"/> Baby was interested in food that I ate |
| <input type="checkbox"/> Baby seemed hungry | <input type="checkbox"/> Recommended by a health professional |
| <input type="checkbox"/> Baby was waking at night | <input type="checkbox"/> Recommended by family / friends |
| <input type="checkbox"/> Other (please specify) | |

2. What developmental cues did your baby show when he or she was ready for solid foods (tick all that apply)?

- | | |
|---|--|
| <input type="checkbox"/> He/she sat up without help | <input type="checkbox"/> Leant forward towards food when it was offered and opened his/her mouth |
| <input type="checkbox"/> Was able to hold his/her head up well | <input type="checkbox"/> Didn't push food out of his/her mouth straight away |
| <input type="checkbox"/> Looked as if he/she was able to eat from a spoon | |
| <input type="checkbox"/> Other (please specify) | |

*3. What was baby's first food?

- | | |
|--|--|
| <input type="radio"/> Rusk | <input type="radio"/> Fruit |
| <input type="radio"/> Baby cereal or baby rice | <input type="radio"/> Red Meat |
| <input type="radio"/> Breakfast cereal | <input type="radio"/> Chicken |
| <input type="radio"/> Vegetables | <input type="radio"/> Fish |
| <input type="radio"/> Yoghurt | <input type="radio"/> Ready-made baby food |
| <input type="radio"/> Other (please specify) | |

How babies feed from birth until 6 months of age

4. Which statement below best describes how you are introducing solid foods into your baby's diet? (please tick the one that most applies)

- Providing pureed foods to baby at first, progressing through the different food textures (mashed, chopped & finger foods) until he/she is eating family foods.
- Avoiding pureed foods and providing finger foods to baby, allowing he/she to feed on their own (you may have heard of this as baby-led weaning).
- Providing pureed foods and allowing he/she to feed on their own using finger foods.

If none of the statements above apply to you, Please describe how you are choosing to introduce solids into your baby's diet

How babies feed from birth until 6 months of age

5. Have you introduced your baby to baby rice?

- Yes I've introduced "branded baby rice" e.g. Watties
 Yes I've introduced homemade baby rice
 No I haven't introduced baby rice

*6. Identify all the foods which you introduced to your baby in the first 2 weeks after starting solids (tick all that apply)

- | | |
|---|-------------------------------------|
| <input type="checkbox"/> Rusk | <input type="checkbox"/> Red Meat |
| <input type="checkbox"/> Baby cereal | <input type="checkbox"/> Chicken |
| <input type="checkbox"/> Baby rice | <input type="checkbox"/> Fish |
| <input type="checkbox"/> Breakfast cereal | <input type="checkbox"/> Pork |
| <input type="checkbox"/> Yoghurt | <input type="checkbox"/> Fruit |
| <input type="checkbox"/> Ready-made baby food | <input type="checkbox"/> Vegetables |
| <input type="checkbox"/> Other, please describe | |

*7. When feeding your baby, which do you give first?

- Milk before solids Solids before milk

If you give solids before milk how old was your baby when you started?

*8. Currently, how many solid meals does your baby usually have per day?

- | | | |
|-------------------------|-------------------------|---------------------------------|
| <input type="radio"/> 0 | <input type="radio"/> 3 | <input type="radio"/> 6 |
| <input type="radio"/> 1 | <input type="radio"/> 4 | <input type="radio"/> 7 or more |
| <input type="radio"/> 2 | <input type="radio"/> 5 | |

9. What type of foods do you use for baby most often?

- Homemade foods Commercially prepared foods (e.g., Watties) Combination

How babies feed from birth until 6 months of age

***10. Has baby started eating red meat?**

Yes

No

If yes, when was red meat introduced (Day/Month/Year)?

How babies feed from birth until 6 months of age

*11. Has baby started eating white meat?

Yes

No

If yes, when was white meat introduced (Day/Month/Year)?

*12. Does your baby have a special diet?

Yes

No

If yes, please specify type of diet.

7. BABY FOODS

*1. Is your baby currently eating any of the following (tick all that apply)?

	Yes	No
Roiled oats	<input type="radio"/>	<input type="radio"/>
Weetbix	<input type="radio"/>	<input type="radio"/>
Breakfast cereal	<input type="radio"/>	<input type="radio"/>
Baby cereal	<input type="radio"/>	<input type="radio"/>
Pasta	<input type="radio"/>	<input type="radio"/>
Rice	<input type="radio"/>	<input type="radio"/>
Bread / toast	<input type="radio"/>	<input type="radio"/>
Crackers	<input type="radio"/>	<input type="radio"/>
Rusks	<input type="radio"/>	<input type="radio"/>
Congee	<input type="radio"/>	<input type="radio"/>

*2. Is your baby currently eating any of the following (tick all that apply)?

	Yes	No
Butter or margarine	<input type="radio"/>	<input type="radio"/>
Cheese	<input type="radio"/>	<input type="radio"/>
Yoghurt	<input type="radio"/>	<input type="radio"/>
Ice cream	<input type="radio"/>	<input type="radio"/>
Custard	<input type="radio"/>	<input type="radio"/>

How babies feed from birth until 6 months of age

*** 3. Is your baby currently eating any of the following meat or meat alternatives (tick all that apply)?**

	Yes	No
Beef	<input type="radio"/>	<input type="radio"/>
Lamb	<input type="radio"/>	<input type="radio"/>
Pork or ham	<input type="radio"/>	<input type="radio"/>
Chicken & poultry	<input type="radio"/>	<input type="radio"/>
Fish	<input type="radio"/>	<input type="radio"/>
Luncheon or sausage	<input type="radio"/>	<input type="radio"/>
Eggs	<input type="radio"/>	<input type="radio"/>
Beans, lentils, chickpea	<input type="radio"/>	<input type="radio"/>
Tofu	<input type="radio"/>	<input type="radio"/>
Nuts or seeds	<input type="radio"/>	<input type="radio"/>

How babies feed from birth until 6 months of age

	Yes	No
* 4. Is your baby currently eating any of the following (tick all that apply)?		
	Yes	No
Dried fruit (e.g. raisins)	<input type="radio"/>	<input type="radio"/>
Popcorn	<input type="radio"/>	<input type="radio"/>
Sweets & lollies	<input type="radio"/>	<input type="radio"/>
Biscuits & cakes	<input type="radio"/>	<input type="radio"/>
Chocolate	<input type="radio"/>	<input type="radio"/>
Muesli bar	<input type="radio"/>	<input type="radio"/>
Chips / crisps	<input type="radio"/>	<input type="radio"/>
Hot chips / fries	<input type="radio"/>	<input type="radio"/>

* 5. Is your baby eating any of the following vegetables and fruits (tick all that apply)?

	Yes	No
Starchy (e.g. potato, kumara)	<input type="radio"/>	<input type="radio"/>
Carrots	<input type="radio"/>	<input type="radio"/>
Pumpkin	<input type="radio"/>	<input type="radio"/>
Banana	<input type="radio"/>	<input type="radio"/>
Avocado	<input type="radio"/>	<input type="radio"/>
Beans and peas	<input type="radio"/>	<input type="radio"/>
Cruciferous (e.g. broccoli, cauliflower, cabbage)	<input type="radio"/>	<input type="radio"/>
Leafy green (e.g. spinach, silverbeet)	<input type="radio"/>	<input type="radio"/>
Citrus (e.g. orange, mandarin)	<input type="radio"/>	<input type="radio"/>
Berries (e.g. blueberry, strawberry)	<input type="radio"/>	<input type="radio"/>
Melon (e.g. watermelon, honeydew)	<input type="radio"/>	<input type="radio"/>
Stone fruit (e.g. apricot, peach)	<input type="radio"/>	<input type="radio"/>
Tropical (e.g. mango, papaya)	<input type="radio"/>	<input type="radio"/>
Other fruit (e.g. apples, grapes, pears)	<input type="radio"/>	<input type="radio"/>
Salad fruits and vegetables (e.g. cucumber, tomato, capsicum)	<input type="radio"/>	<input type="radio"/>
Other vegetables (e.g. zucchini, asparagus)	<input type="radio"/>	<input type="radio"/>

How babies feed from birth until 6 months of age

6. Has your baby had any of the following added to his/her food (tick all that apply)?

	Yes	No
Sugar	<input type="radio"/>	<input type="radio"/>
Honey	<input type="radio"/>	<input type="radio"/>
Golden or maple syrup	<input type="radio"/>	<input type="radio"/>
Artificial sweetener	<input type="radio"/>	<input type="radio"/>
Other sweetener	<input type="radio"/>	<input type="radio"/>
Salt	<input type="radio"/>	<input type="radio"/>
Oil	<input type="radio"/>	<input type="radio"/>

How babies feed from birth until 6 months of age

Yes

No

7. Are there any other foods not previously listed which your baby has eaten?

No

Yes

If yes, please list all foods your baby has eaten that have not previously been listed.

8. Would you be willing to complete a food diary for your baby?
(this would involve recording everything which your baby eats for 1 week)

Yes

No

8. PROBLEMS WITH BREASTFEEDING

*1. Did you have any problems with feeding your baby in the first two weeks after being discharged home?

Yes

No

If yes, please describe

2. Did you have any problems with feeding your baby after the first two weeks of being at home?

Yes

No

3. Did you get enough support with feeding your baby?

Yes

No

How babies feed from birth until 6 months of age

4. What other support has helped with feeding your baby?

- | | |
|---|---|
| <input type="checkbox"/> Whānau /family | <input type="checkbox"/> Husband/partner |
| <input type="checkbox"/> Friends | <input type="checkbox"/> Books & magazines |
| <input type="checkbox"/> Internet | <input type="checkbox"/> Parenting course or groups |
| <input type="checkbox"/> Other (please specify) | |

5. Would you have liked more support or information on any of the following? (tick all that apply)

- | | |
|---|--|
| <input type="checkbox"/> Breastfeeding | <input type="checkbox"/> Starting solid foods |
| <input type="checkbox"/> Infant formula | <input type="checkbox"/> I received enough support |
| <input type="checkbox"/> Other (please specify) | |

6. Did you consult with a health professional about feeding your baby?

- Yes No

9. GENERAL HEALTH

1. If yes to the previous question, which healthcare professionals did you consult with? Please tick all that apply:

- | | | |
|---|--|---|
| <input type="checkbox"/> Plunket Nurse | <input type="checkbox"/> Māori health provider | <input type="checkbox"/> Lactation consultant |
| <input type="checkbox"/> Midwife | <input type="checkbox"/> General practitioner (GP) | |
| <input type="checkbox"/> Other (please specify) | | |

How babies feed from birth until 6 months of age

2. Have you or your baby had any of the following feeding issues since birth? Tick all that apply

- | | | |
|---|--|---|
| <input type="checkbox"/> Mastitis | <input type="checkbox"/> Colic / excessive crying | <input type="checkbox"/> Tongue tie |
| <input type="checkbox"/> Breast feeding was painful | <input type="checkbox"/> Reflux requiring medication | <input type="checkbox"/> Over supply of breast milk |
| <input type="checkbox"/> Poor latching during breastfeeding | <input type="checkbox"/> Reflux not requiring medication | <input type="checkbox"/> Not growing well |
| <input type="checkbox"/> Insufficient breast milk supply | <input type="checkbox"/> Milk intolerance | <input type="checkbox"/> Other |

If you selected milk intolerance, not growing well, and/or other, please describe

How babies feed from birth until 6 months of age

3. Did your baby receive paediatric care on either a postnatal ward or in a special care baby unit after they were born?

- Yes
 No

10. Paediatric care

1. Do you remember why your baby was admitted under paediatric care? (tick all that apply)

- Baby was born with a medical condition
 Low blood sugars at birth
 Baby was born premature
 Baby had a low birth weight
 Baby had lost too much weight whilst in hospital
 Breastfeeding problems
 Mum had diabetes
 Breathing difficulties at birth, this is often known as respiratory distress.

Other, please specify

2. Was your baby admitted to a special care baby unit after he/she was born?

- Yes
 No

If yes, how long was baby admitted to the special care baby unit?

11. A LITTLE ABOUT YOU AND YOUR BABY

In order to describe the participants who take part in our study we need to ask a few questions about you and your baby.

How babies feed from birth until 6 months of age

*** 1. What ethnic group do you most identify with? (please tick the one that most applies)**

- New Zealand European
- Other European
- Māori
- Cook Island Māori
- Samoan
- Tongan
- Niuean
- Other Pacific Island
- Chinese
- Other Asian
- Indian Asian
- Other (please specify)

2. What is your age?

3. Was this your first baby? (Please tick one)

- Yes No

How babies feed from birth until 6 months of age

***4. What ethnic group do you most identify your baby with? (tick the one that most applies)**

- New Zealand European
- Other European
- Māori
- Cook Island Māori
- Samoan
- Tongan
- Niuean
- Other Pacific Island
- Chinese
- Other Asian
- Indian Asian

Other (please specify)

How babies feed from birth until 6 months of age

12. BABY'S MEASUREMENTS

1. If you can remember, how much did your baby weigh at birth?

(You can often find this information in your well-child/plunket book that you were given when your baby was born). If you don't know please skip.

2. If you can remember, what was the head circumference of your baby at birth?

(You can often find this information in your well-child/plunket book that you were given when your baby was born). If you don't know please skip.

3. If you can remember, what was the length of your baby at birth?

(You can often find this information in your well-child/plunket book that you were given when your baby was born). If you don't know please skip.

4. What was the most recent weight of your baby? When was this weight taken (day/month/year)? If you don't know please skip.

5. What was the most recent head circumference measurement of your baby? When was this measurement taken (day/month/year)? If you don't know please skip.

How babies feed from birth until 6 months of age

6. What was the most recent length measure of your baby? When was this taken (day/month/year)? If you don't know please skip.

13. THANK YOU FOR COMPLETING THE SURVEY

1. What is the best way to send you the next feeding questionnaire at 12 months?

- I do not wish to complete the 12 month infant feeding questionnaire
- Email
- Please send me a hard copy of the questionnaire

If you have selected email or please send me a hard copy, can you please write the address you wish the questionnaire to be sent to below.

2. Thank you for completing this questionnaire.

If there is anything else you would like to tell us about feeding your baby you can use the box below:



MASSEY UNIVERSITY
COLLEGE OF HEALTH
TE KURA HAUORA TANGATA

Parental reporting of infant feeding practices study

ID No:.....

DETAILS REGARDING THE BIRTH EVENT

Mother age:

Primigravida: Primip

Multip (No).....

Delivery date:/...../.....

Type of delivery:

NVD

NVD-induced

Elective LSCS

Emergency LSCS

Ventose

Forceps

Gestational age:weeks

Birth weight:g

Discharge weight:g

Birth Length:cm

Head circumference:cm

Sex: F / M

Number of days under paed care:

Reason for Admission to NICU:

Reason for Admission to post natal ward: Paed care LSCS Maternal reason

DETAILS REGARDING FEEDING

Discharge feeding method

Exclusive Breastfeeding

Fully/Predominantly Breastfeeding

Partial Breastfeeding

Artificially feeding