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Maternal and Paternal Influences on Infant Diet and Growth Throughout the First Year of Life.

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Maternal and paternal influences on infant diet and growth throughout the first year of life

A thesis submitted for the degree of Doctor of Philosophy

by

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ABSTRACT

Aim and objectives: The overall aim of this research was to investigate maternal and paternal behaviours and attitudes and their influences on the diet and growth of infants in the first year of life. Specific objectives were to assess: maternal wellbeing and breastfeeding outcomes; weaning and supplementation practices; infant growth and body composition; and the views of fathers on having a breastfeeding partner.

Methodology: The first study was a prospective observational study, involving the recruitment of 270 pregnant women from the public and semi-private antenatal clinics of the Coombe Women and Infants University Hospital. Mother-infant dyads were then followed-up at birth and at four, nine and 12 months post-partum. Data were obtained on maternal wellbeing and on infant milk feeding, weaning practices and growth.

The second study was a cross-sectional study in which a semi-quantitative questionnaire explored the feeding experiences of 417 men whose partner breastfed.

Results: Of the sample of 270 pregnant women, 55.9% (*n*151) initiated breastfeeding. From this initial sample, 172 mothers were followed-up at four months post-partum, and 36.0% (*n*62) of these mothers were distressed. Controlling for other factors, distress was significantly (p=0.01) more likely at this time if a mother was breastfeeding. Only two in five (42.9%, *n*47) of these mothers put supports in place to help them to breastfeed, and of the 417 men whose partner breastfed, almost half (49.4%, *n*117) were unable to help their partner when she experienced breastfeeding difficulties.

Of the 158 infants followed-up to one year of age, the average age at which they were weaned on to solid food was 20.7 weeks and 86.1% (*n*136) were weaned at or after 17 weeks of age. Only 57.6% (*n*91), 34.2% (*n*54) and 23.4% (*n*37) of infants were being correctly supplemented with vitamin D at four, nine and 12 months of age, respectively. Supplementing as recommended was significantly more likely if mothers had received advice on doing so from a health professional. Regarding growth, 28.5% (*n*45) of infants grew rapidly during the first year of life, with male infants having a significantly (p<0.01) higher fat-free mass at birth and at age one year, compared to females.

Conclusions: Parents need structured guidance to assist them in preparing for breastfeeding. Health professionals must persist in promoting healthy weaning and vitamin D supplementation practices. Further research is needed to identify clinically useful ways in which the growth and body composition of infants can be assessed.

DECLARATION OF WORK

I certify that this thesis, which I now submit for examination for the award of Doctor of Philosophy, is entirely my own work and has not been taken from the work of others, save and to the extent that such work has been cited and acknowledged within the text of my work.

This thesis was prepared according to the *Dublin Institute of Technology* Regulations for Postgraduate Study by Research and has not been submitted in whole or in part for another award in any other third level institution.

The work reported in this thesis conforms to the principles and requirements of *Dublin Institute of Technology's* guidelines for ethics in research.

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Candidate

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ABBREVIATIONS

ANOVA	Analysis of variance
BIS	Bioimpedance spectroscopy
BLW	Baby-led weaning
BMI	Body mass index
BSQ	Body Shape Questionnaire
CFQ	Child Feeding Questionnaire
CI	Confidence interval
cm	Centimetre
CSO	Central Statistics Office
CVD	Cardiovascular disease
CWIUH	Coombe Women and Infants University Hospital
EPDS	Edinburgh Post-partum Depression Scale
FSAI	Food Safety Authority of Ireland
g	Grams
HRB	Health Research Board
HSD	Honest Significant Difference
HSE	Health Service Executive
IBM	International Business Machines Corporation
ID	Identification
IQR	Interquartile range
IUNA	Irish Universities Nutrition Alliance
kcal	Kilocalorie
kg	Kilogram
kJ	Kilojoule
m^2	Metres squared
MABISC	Mother and Baby Interaction Scale
MBCT	Mindfulness-based Cognitive Therapy

ABBREVIATIONS *(continued)*

mls	Millilitres
n	Sample size
NALA	National Adult Literacy Agency
NPNS	National Preschool Nutrition Survey
OR	Odds ratio
p	Probability
PBQ	Post-partum Bonding Questionnaire
RCPCH	Royal College of Paediatrics and Child Health
SACN	Scientific Advisory Committee on Nutrition
SD	Standard deviation
SES	Socioeconomic status
SPSS	Statistical Package for the Social Sciences
T2DM	Type II diabetes mellitus
TPDS	Tilburg Pregnancy Distress Scale
UK	United Kingdom
UK90	British 1990 growth reference for children aged 0-4 years
UK-WHO	United Kingdom-World Health Organisation
UNICEF	United Nations Children’s Emergency Fund
WFL	Weight-for-length
WHO	World Health Organisation

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OUTLINE OF THE THESIS

This thesis examines the possible influences of maternal and paternal attitudes and behaviours on the diet and growth of infants in the first year of life. Particular emphasis is placed on the associations between the dietary and growth outcomes of infants and the wellbeing, sociodemographic characteristics and health behaviours of mothers (**Figure i.1, overleaf**). The ways in which a father is associated with maternal preparation for motherhood and breastfeeding are also explored (**Figure i.1, overleaf**).

Chapter One summarises the published literature relevant to the areas of interest.

Chapter Two details the methodologies used to fulfil the study aims and objectives.

Chapter Three provides a detailed description of the sociodemographic characteristics and health behaviours of the population samples in this study: pregnant women, mothers at birth and at four, nine and 12 months post-partum, infants at birth and at four, nine and 12 months of age, and fathers who have a breastfeeding partner.

Chapter Four presents and discusses the associations between aspects of maternal wellbeing and milk feeding outcomes. The thesis then progresses from influences on milk feeding practices to influences on weaning and supplementation in **chapter five**.

Chapter Five presents data on the weaning diet and on vitamin D supplementation at four, nine and 12 months of age. The data presented are compared with recommendations and discussed. The data obtained on milk feeding and weaning in **chapters four** and **five** are used with maternal sociodemographic and health behavioural data to explore possible influences on infant growth in **chapter six**.

Chapter Six explores and discusses possible influences on infant growth and body composition. This chapter marks the end of the examination of maternal influences on infant diet and growth. The thesis then seeks to explore how a father influences, and participates in, the breastfeeding relationship in **chapter seven**.

Chapter Seven presents and discusses the results of a cross-sectional study on the attitudes of fathers whose partner had breastfed their last, or only, child.

Chapter Eight provides a synthesis of all the findings presented, and puts them into context. The potential implications of the research for practice are highlighted and suggestions for future research are made.

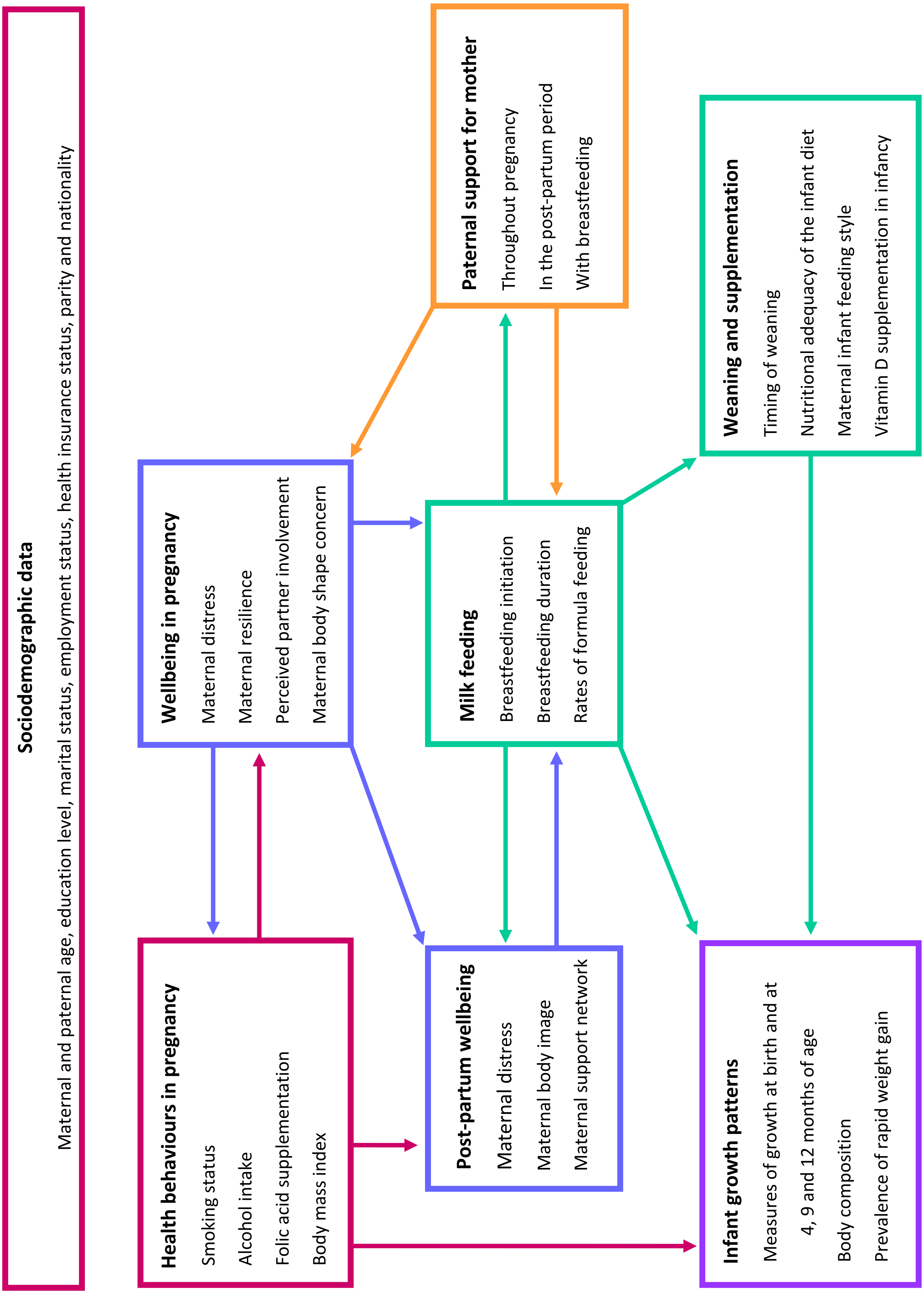

Figure i.1 Conceptual framework for maternal and paternal influences on infant diet and growth throughout the first year of life

CHAPTER 1 Summary of the literature

1.1 Introduction

The importance of dietary habits and growth patterns in infancy is such that their consequences resonate throughout the entire life cycle. Therefore, it is important to shed light on factors which influence the development of infant dietary habits and growth patterns, in a bid to reduce the likelihood of adverse health outcomes. This chapter will summarise the literature relevant to each of the areas of investigation in this thesis, and in so doing, will emphasise the rationale which underpins the research questions in **chapters four**, **five**, **six** and **seven**.

This chapter will first discuss the literature relevant to the results presented in **chapter four**, which investigates the associations between maternal wellbeing and breastfeeding outcomes. The already well-established and widely reported benefits of breastfeeding for mother and infant will *not* be summarised in this chapter, nor will be the longstanding suboptimal breastfeeding rates in Ireland. Rather, this part of the chapter aims to succinctly convey how maternal wellbeing is related to breastfeeding outcomes and to highlight the gaps in the literature on this topic within the Irish context. This section will be followed by a discussion on the paternal perspective on breastfeeding, since results relating to this topic are presented in **chapter seven**.

This chapter will then move beyond breastfeeding to dietary intakes during weaning and vitamin D supplementation in infancy, which are the areas under investigation in **chapter five**. Finally, the literature on infant growth and body composition will be discussed, thus reflecting the results presented in **chapter six**.

Therefore, this chapter will summarise recent and relevant literature on maternal and paternal factors which influence infant diet and growth. In doing so, this chapter will shed light on the relevance of this thesis, by underscoring the research to date on the areas of investigation and highlighting the gaps within this body of research which this thesis will aim to address.

1.2 Maternal wellbeing and breastfeeding outcomes

The events of pregnancy, labour and the arrival of a healthy infant are highly emotional experiences for women. While joy is so often associated with these events, so too is some degree of apprehension in the face of motherhood and its accompanying challenges (Coates *et al.*, 2014). Therefore, given that the transition to motherhood can simultaneously represent the emotional extremes of intense joy and intense anxiety, it is important to investigate how a woman's emotional wellbeing is associated with her parenting choices and her infant's resulting health outcomes (Munk-Olsen *et al.*, 2006).

1.2.1 What does the construct of "maternal wellbeing" encompass?

Maternal wellbeing refers to a spectrum of psychological, emotional and behavioural influences during pregnancy, birth and the postnatal period (Fontein-Kuipers *et al.*, 2015). The term *maternal distress* most commonly encompasses depression, anxiety and/or perceived stress related to the birth and care of an infant (Fontein-Kuipers *et al.*, 2015; Staneva *et al.*, 2015). These components of maternal distress can create an imbalance within the spectrum of maternal wellbeing, resulting in a strained ability to competently function (Emmanuel and St. John, 2010).

Breastfeeding is a complex process which is often regarded as a challenging function of the mothering role (Thomson *et al.*, 2015), and is closely related to a woman's sense of wellbeing (Cooke *et al.*, 2007; Avery *et al*., 2009; Bloomfield and Kendall, 2012). Therefore, the associations between a distressed sense of maternal wellbeing and breastfeeding will be explored.

1.2.2 Challenges in cultivating a positive sense of wellbeing towards breastfeeding

Despite the myriad of benefits associated with breastfeeding (Kramer and Kakuma, 2002; Gartner *et al.*, 2005), choosing not to breastfeed, or choosing to cease breastfeeding shortly after its initiation, are choices many mothers in Ireland make (Layte and McCrory, 2014). The nationally representative Growing Up in Ireland study reported a breastfeeding initiation rate of 50.1% and a breastfeeding rate on discharge from hospital of 42.5% amongst Irish mothers (Layte and McCrory, 2014), rates which are well below European averages (Brick and Nolan, 2014).

Breastfeeding is frequently associated with feelings of anxiety and self-doubt (Loomans *et al.*, 2012; Williamson *et al.*, 2012). A woman is more likely to negate these distressing feelings if she fosters a positive sense of wellbeing towards breastfeeding (Fontein-Kuipers *et al.*, 2015). This positive sense of wellbeing encompasses: a positive antenatal intention to breastfeed; a strong sense of breastfeeding self-efficacy; and a helpful network of social support (Avery *et al.*, 2009; O'Brien *et al.*, 2009; Staneva *et al.*, 2015; Yang *et al.*, 2016).

However, two challenges associated with fostering a positive sense of wellbeing towards breastfeeding within the Irish context must be highlighted. Firstly, Ireland has a long-standing and dominant formula feeding culture (Brick and Nolan, 2014). This decades-long culture of formula feeding is so deeply entrenched that it has proven highly resistant to change in favour of breastfeeding (Brick and Nolan, 2014). Therefore, many Irish families lack any history of breastfeeding (Tarrant and Kearney, 2008), making it a challenging skill for an expectant mother to prepare for, or for a new mother to adopt.

Secondly, and building on the first point, it would be understandable if women who felt positive about their ability to breastfeed found doing so challenging within the infant feeding environment in Ireland. Therefore, for women who harbour anxieties and doubts about their ability to breastfeed, as many Irish women do (Layte and McCrory, 2014), a positive breastfeeding experience may be even more difficult to accomplish.

Consequently, it is important that these challenges are borne in mind when devising strategies to help Irish women to foster a sense of wellbeing which is conducive to a positive breastfeeding outcome.

1.2.3 The components of a positive sense of wellbeing towards breastfeeding

A positive sense of wellbeing towards breastfeeding can be initially cultivated by encouraging women to adopt a positive antenatal intention to breastfeed. A strong positive correlation has been consistently reported between a positive antenatal intention to breastfeed and initiating breastfeeding in the post-partum period (Kronborg and Væth, 2004; Tarrant *et al.*, 2009; Bai *et al.*, 2010; de Jager *et al.*, 2014). For example, Tarrant *et al.* (2009) reported that pregnant women who intended to breastfeed were 224 times more likely to initiate breastfeeding when compared to pregnant women who were undecided about breastfeeding or who did not intend to breastfeed. Additionally, O'Brien *et al.* (2008) reported that women were 72.0% more likely to exclusively breastfeed if they made plans in pregnancy to do so for a specific length of time after birth. Therefore, it is important that health professionals capitalise on a positive intention to breastfeed, especially amongst women who may feel anxious about doing so, by providing education on the difficulties often associated with establishing breastfeeding, and empowering women to persist despite these short-lived undesirable aspects of breastfeeding (Taylor and Wallace, 2012; Thomson *et al.*, 2015).

This empowerment through education is necessary to prevent discrepancies between a woman's expectations of breastfeeding and the reality of her breastfeeding experience. When such discrepancies arise, disillusionment with breastfeeding can manifest, thus causing or exacerbating maternal distress, which in turn can increase the likelihood of early breastfeeding cessation (O'Brien *et al.*, 2008; de Jager *et al.*, 2013). For example, a prospective longitudinal study by Vilela *et al.* (2014) reported that women exhibiting signs of distress after birth were 61.0% more likely to cease breastfeeding early compared to those who exhibited no signs of distress. Similarly, a longitudinal study of almost 900 families in Finland reported that while prenatal depressive symptoms were not associated with the duration of breastfeeding, postnatal depressive symptoms were associated with shorter breastfeeding duration (Ahlqvist-Björkroth *et al.*, 2016). Therefore, to reduce or prevent maternal distress in the post-partum period, it is important to enhance a woman's breastfeeding self-efficacy *in addition to* encouraging her to form a positive antenatal intention to breastfeed.

Self-efficacy refers to an individual's confidence in their perceived ability to competently perform a specific behaviour (Bandura, 1977). *Breastfeeding self-efficacy* specifically refers to a woman's evaluation of her ability to breastfeed (Dennis, 1999). In Ireland, the steepest decline in rates of breastfeeding occurs within the first week post-partum and the main reason given for breastfeeding cessation is the mistaken belief that a woman cannot produce adequate volumes of milk to meet her infant's needs (Layte and McCrory, 2014). Therefore, it is important that women feel confident in their breastfeeding abilities from the outset, *i.e.* that they have a strong sense of breastfeeding self-efficacy, even in pregnancy (McInnes and Chambers, 2008; Thomson *et al.*, 2015; Yang *et al.*, 2016).

Women who feel confident in their ability to breastfeed and who have faith in the capacity of their breast milk to support their young infant's needs are significantly more likely to breastfeed for a longer period of time (O'Brien *et al.*, 2008; Hinic, 2016). For example, Yang *et al.* (2016) reported that in a sample of almost 600 mothers, attending antenatal education classes on breastfeeding was significantly associated with higher breastfeeding self-efficacy, and de Jager *et al.* (2014) found that higher breastfeeding self-efficacy was positively associated with breastfeeding duration, a finding reported elsewhere (Blyth *et al.*, 2002; Scott *et al.*, 2006; Semenic *et al.*, 2008; Ahlqvist-Björkroth *et al.*, 2016). Therefore, it is important that health services recognise that in order to promote higher rates of breastfeeding initiation *and* duration, women must not only be encouraged to initiate breastfeeding, but educated and empowered to *confidently* commit to breastfeeding for as long as possible (Cooke *et al.*, 2007).

1.2.4 Strategies to enhance a positive sense of wellbeing towards breastfeeding

Although often perceived as a harmonious process, breastfeeding is challenging, particularly in the early weeks during which the maternal milk supply is established (Cooke *et al.*, 2007; Dykes and Flacking, 2010). Issues such as interrupted sleep, painful breasts and inadequate social support can increase maternal distress, compromise a woman's sense of emotional wellbeing and, therefore, challenge her commitment to breastfeeding (McInnes and Chambers, 2008). As such, it is important to devise strategies which bolster a woman's ability to support herself in the face of challenges to her wellbeing which are related to breastfeeding (Altmaier and Maloney, 2007; Bloomfield and Kendall, 2012; Byrne *et al.*, 2014). It is also important to teach a woman's support network how to effectively help her as she breastfeeds (Goodman, 2005; Pisacane *et al*., 2005; Susin and Giugliani, 2008).

Strategies to bolster a woman's ability to cope in the face of breastfeeding-related challenges will first be explored. Previous research has demonstrated the effectiveness of using mindfulness and cognitive behavioural therapy techniques to enhance maternal self-efficacy and resilience (Duncan *et al.*, 2009; Dunn *et al.*, 2012; Perez-Blasco *et al.*, 2013; Goodman *et al.*, 2014; Meppelink *et al.*, 2016). For example, compared to controls, a mindfulness-based cognitive therapy (MBCT) intervention for pregnant women demonstrated clinically reliable reductions in stress, depression and anxiety amongst participants over the 8-week intervention (Dunn *et al.*, 2012). The intervention included teaching pregnant women how to foster acceptance, manage negative thoughts and deal with obstacles, and the resulting improvements in wellbeing continued into the postnatal period (Dunn *et al.*, 2012). Similarly, another 8-week MBCT intervention, which was provided in weekly sessions, each of two hours duration, resulted in statistically and clinically significant reductions in stress, depression and anxiety, while significantly increasing self-compassion and mindfulness

(Goodman *et al.*, 2014). Furthermore, the results of a qualitative study, which investigated the strategies employed by Australian women who breastfed despite challenging circumstances, echo these findings (O'Brien *et al.*, 2009). This study found that although the women received no formal guidance on coping strategies, many of them seemed to innately employ simple cognitive behavioural techniques to help them to cope with breastfeeding difficulties, such as positive self-talk, mindfulness and challenging unhelpful beliefs (O'Brien *et al.*, 2009).

Therefore, some structured guidance on cognitive behavioural therapy techniques and MBCT may reinforce innate coping mechanisms and strengthen a woman's ability to manage breastfeeding challenges. However, although the results of these and other studies are promising in terms of safeguarding maternal wellbeing throughout the breastfeeding experience, investigation into the use of MBCT amongst pregnant women and new mothers is relatively recent. A review of 17 such studies recommended, perhaps unsurprisingly, that further research is needed to substantiate the benefits of MBCT for maternal wellbeing (Lever Taylor *et al.*, 2016). Additionally, although it has been reported that MBCT impacts maternal wellbeing, and that maternal wellbeing impacts breastfeeding, no intervention studies to date have combined these two and examined the impact of teaching MBCT to expectant or new mothers on breastfeeding outcomes.

1.2.5 Strategies to educate the support network of a breastfeeding mother

In addition to helping women to support themselves as they experience challenges with breastfeeding, health services should also provide guidance to a woman's family and social network on helpful ways to offer breastfeeding support (Avery *et al.*, 2009; Bloomfield and Kendall, 2012).

An observational study by Tarrant *et al.* (2009) found that women who received positive encouragement from their partner and mother were 7.9 and 6.2 times more likely to initiate breastfeeding, respectively. Once breastfeeding is initiated, however, it is important that families offer informed support to help a mother to breastfeed (O'Brien *et al.*, 2008; Duncan *et al.*, 2009). As already stated, the skill of breastfeeding has been lost to many Irish families (Tarrant and Kearney, 2008), and therefore, family members, especially fathers (Bennett *et al.*, 2016) and maternal grandmothers (Tarrant *et al.*, 2009), should be educated on how to support a mother in a manner which does not compromise breastfeeding (McInnes and Chambers, 2008; Byrne *et al.*, 2014).

Although many studies report a positive association between support from a woman's social network and breastfeeding success (Avery *et al.*, 2009; Tarrant *et al.*, 2009; Bloomfield and Kendall, 2012; Perez-Blasco *et al.*, 2013), few studies have specifically examined how to best educate a woman's wider family on supporting breastfeeding. Most studies which have investigated the impact of a woman's support network on breastfeeding outcomes have focused on the impact made by a woman's partner, and this aspect of the breastfeeding process will be discussed in the next section (**section 1.3**) of this chapter.

1.2.6 Directions for research on maternal wellbeing and breastfeeding outcomes

There has been little investigation into the associations between validated measures of maternal wellbeing (*e.g.* distress, self-efficacy) and breastfeeding outcomes in the Irish context. An investigation into these associations could provide valuable insights into the aspects of maternal wellbeing which could be bolstered throughout pregnancy in an effort to improve breastfeeding rates.

Furthermore, there have been no published interventions examining the impact of providing practical guidance to pregnant women which empowers them to confidently commit to breastfeeding. Such interventions could provide definitive guidance on how to best prepare women for their breastfeeding journey and ought to be considered in future Irish breastfeeding research.

1.2.7 Conclusions on maternal wellbeing and breastfeeding outcomes

Women have reported a sense of loss in terms of their autonomy, body image, femininity, sexuality and occupational identity as they make the transition to motherhood (Nicolson, 1999; Homewood *et al.*, 2009). The distress which can be associated with this altered sense of self can be compounded by the distress which is often associated with the rewarding but challenging task of breastfeeding (Coates *et al.*, 2014; Thomson *et al.*, 2015).

Therefore, it is essential that as women are establishing breastfeeding in the midst of the life-changing responsibility of motherhood, efforts are being made by health services, families and women themselves, to protect maternal wellbeing. In turn, this investment can reap dividends in the form of better breastfeeding outcomes, and therefore better maternal and infant health outcomes.

1.3 Role of a father in the breastfeeding process

Several studies have investigated reasons why mothers in Ireland never initiate, or discontinue, breastfeeding. Common reasons include: perceived milk insufficiency; difficulty with breastfeeding techniques; maternal fatigue; and the perceived negative impact of breastfeeding on lifestyle (Begley *et al*., 2008; Tarrant *et al*., 2011; Layte and McCrory, 2014; Leahy-Warren *et al.*, 2014). Therefore, in addition to the internal emotional influences which are associated with suboptimal breastfeeding outcomes and are outlined in **section 1.2**, Irish mothers also avoid or cease breastfeeding due to technical difficulties and inadequate practical and emotional support.

Women can be discharged from hospital from as little as six hours post-delivery and the majority of women are discharged from hospital within 48 hours of giving birth (Coombe Women and Infants University Hospital, 2014). Shorter hospital stays inevitably result in a reduction in contact time with health professionals in the early post-partum period, yet the time needed to become proficient in the technical aspects of breastfeeding remains unchanged. Therefore, the gap in breastfeeding support created by reduced access to health professionals must be filled by identifying those individuals to whom mothers have ready access and equipping them with the technical skills needed to help mothers to establish breastfeeding.

As already mentioned in **section 1.2.5**, an effective support network for breastfeeding mothers has been identified as a key factor in the success of breastfeeding (Avery *et al*., 2009). International studies have shown that a woman's partner can have a significant influence on her decision to initiate and continue breastfeeding (Scott *et al.*, 2001; Pontes *et al*., 2008; Susin and Giugliani, 2008). However, despite the fact that fathers can provide a continuity of care to mothers in the post-partum period which no health professional can offer, only one small study (Kenosi *et al*., 2011) has been conducted in Ireland to date on the views of fathers on the breastfeeding process.

1.3.1 Potential benefits of informed paternal support for breastfeeding

Observational studies have consistently highlighted the significance of a father's role in breastfeeding outcomes (Freed *et al.*, 1992; Arora *et al*., 2000; Scott *et al.*, 2001; Kong and Lee, 2004; Persad and Mensinger, 2008; Pontes *et al*., 2008; Susin and Giugliani, 2008; Tarrant *et al.*, 2009; Tarrant *et al.*, 2011).

For example, in an Irish observational study by Tarrant *et al*. (2009), women were eight times more likely to initiate breastfeeding when they received positive encouragement to do so from their partner. Scott *et al*. (2001) reported that women who perceived their partner to be supportive of breastfeeding were 11 times more likely to breastfeed on discharge from hospital. Paternal support has also been associated with increased breastfeeding duration, with mothers in receipt of positive paternal support reporting a greater sense of confidence and competence when dealing with feeding challenges (Gage and Kirk, 2002; Swanson and Power, 2005; Garfield and Isacco, 2006; Hauck *et al.*, 2007; Mannion *et al*., 2013).

However, despite the positive results of observational studies, the results of intervention studies which aimed to improve breastfeeding outcomes by educating fathers on breastfeeding have been less consistent. Some intervention studies have reported that there is no association between paternal breastfeeding education and improved breastfeeding outcomes (Susin and Giugliani, 2008; Lovera *et al*., 2010) and others have reported significant associations in this regard (Ingram and Johnson, 2004; Wolfberg *et al.*, 2004; Pisacane *et al.*, 2005; Nickerson *et al*., 2012).

For example, Wolfberg *et al.* (2004) reported significantly different breastfeeding initiation rates of 74.0% and 41.0% in two groups of women whose partner did and did not attend a breastfeeding class during their pregnancy, respectively. Furthermore, Pisacane *et al.* (2005) reported that the provision of 40 minutes of breastfeeding education to fathers resulted in a significantly higher exclusive breastfeeding rate of 25.0% at 26 weeks post-partum amongst their partners, compared to just 15.0% of controls. Even in the study by Lovera *et al.* (2010), which reported no significant difference in breastfeeding rates between intervention and control groups, 63.4% of fathers in the intervention group had a partner who exclusively breastfed for 26 weeks, compared to 54.6% of controls. Although not statistically significant, this difference could be considered clinically significant, and perhaps statistical significance may result with a larger study sample size (Lovera *et al.*, 2010).

Ultimately, most intervention studies have shown that supportive paternal involvement has a significant positive impact on some aspect of breastfeeding, whether it is initiation (Wolfberg *et al*., 2004), feeding on discharge (Scott *et al*., 2001) or duration (Pisacane *et al*., 2005; Nickerson *et al*., 2012; Maycock *et al*., 2013). That said, a recent systematic review of such interventions has concluded that larger intervention studies and studies which more fully investigate the relationship between paternal involvement and breastfeeding duration are needed (Mitchell-Box and Braun, 2013).

Although more research is needed, the research to date generally indicates that paternal involvement positively impacts breastfeeding outcomes. Therefore, meaningful efforts should be made to involve expectant fathers in the breastfeeding process.

1.3.2 Current efforts to involve fathers in the breastfeeding process

Pregnancy is a particularly unique time during which health professionals often have access to both parents simultaneously. As such, the antenatal period is an opportune time to encourage fathers to become actively involved in the breastfeeding process.

Men want to be recognised as an important part of the breastfeeding process, and often want specific advice, *not* basic or general information, about supporting their breastfeeding partner (Sherriff and Hall, 2011; Datta *et al.*, 2012; Brown and Davies, 2014). Inconsistent guidance from health professionals and a lack of male-only antenatal education often stymie the efforts of fathers and fathers-to-be to confidently support breastfeeding (Whelan and Kearney, 2014; Hunter *et al*., 2015). Furthermore, antenatal classes often do not adequately address the needs and roles of men in the post-partum period (Friedewald *et al.*, 2005). However, since fathers are important to health outcomes in mothers and infants, meeting the needs of fathers during this time is a necessary, if distal, part of adequate healthcare for mothers and infants.

A more concerted effort by health professionals to include fathers may be prioritised if the role of fathers in breastfeeding is given greater acknowledgement in national strategies and policies. For example, the most recent Irish breastfeeding strategy (Department of Health and Children, 2005) refers to the need to include partners in the maternal breastfeeding network, but does not specify how this is to be done. Additionally, the current National Infant Feeding Policy (Food Safety Authority of Ireland [FSAI], 2011) makes no mention of the role of fathers in breastfeeding. Men cannot be expected to adopt an informed, practical and supportive role in breastfeeding if their own needs around breastfeeding are not also acknowledged and met.

Since the milk feeding decision is usually made during pregnancy (Chye *et al*., 1997; Donath *et al*., 2003; Tarrant *et al*., 2009) and possibly as early as the first trimester (Arora *et al*., 2000), encouraging men to advocate breastfeeding is an important consideration for maternity services. It is also important to recognise that since feeding decisions are often made in early pregnancy, steps should be taken to cultivate a positive attitude towards breastfeeding amongst men in the general population; an attitude which can then be reinforced throughout pregnancy.

1.3.3 Societal attitudes towards a breastfeeding family

The pervasively low rates of breastfeeding throughout all levels of Irish society (Williams *et al.*, 2010; Layte and McCrory, 2014) mean that there are few opportunities for breastfeeding to be experienced as part of everyday life by the general public. If a woman in Ireland perseveres with breastfeeding, she must do so in a society in which infant feeding is synonymous with formula feeding. Therefore, while breastfeeding may be the biological norm, it is not the social or cultural norm in Ireland at present.

Social and cultural norms significantly affect the initiation and duration of breastfeeding (McFadden and Toole, 2006; Brown *et al*., 2011; Boyer, 2011; Vari *et al*., 2012). Women have reported feeling embarrassed while breastfeeding in public (Earle, 2002; Hauck, 2004; Begley *et al*., 2008; Tarrant *et al*., 2011), even in the absence of negative attention (Sheeshka *et al*., 2001). Therefore, it is important to work towards establishing an environment in which breastfeeding is perceived as an essential everyday activity, in order to foster a more tolerant attitude towards breastfeeding in public (Meng *et al*., 2013). However, normalising breastfeeding in a country with a formula feeding culture requires extensive promotion of breastfeeding within schools, colleges, health services, workplaces, businesses and public spaces.

Enhancing social support is one of the key strategies needed to increase breastfeeding rates (United Nations Children's Emergency Fund, 2015). Therefore, to breastfeed in public in a society in which breastfeeding beyond the first few weeks postpartum is almost a remarkable occurrence, women must feel confident, knowledgeable and supported with their feeding decision (Brown, 2015). Women with supportive partners are more likely to meet this description (Tohotoa *et al*., 2009; Rempel and Rempel, 2011), and therefore the potential impact of paternal support should be offered greater appreciation and recognition within breastfeeding promotion.

1.3.4 Directions for research on the role of a father in breastfeeding

The literature consistently indicates that fathers play an important role in providing support to breastfeeding mothers and their infants. However, to the author's knowledge, only one study (Kenosi *et al*., 2011) has been conducted to date on the attitude of fathers in Ireland towards breastfeeding. This study had a small sample of 67 fathers who answered the study questionnaire within two days of the birth of their child, thus greatly limiting the depth and breadth of the information obtained.

A gap clearly exists in terms of our basic understanding of male attitudes and knowledge around breastfeeding in Ireland. Before interventions can be designed to measure the impact of educating fathers on breastfeeding, it is important that a comprehensive baseline understanding of breastfeeding knowledge and attitudes amongst fathers in Ireland is obtained. It is only by obtaining this baseline measure that directions for future research on this subject within the Irish context will be made clear.

1.3.5 Conclusions on the role of a father in breastfeeding

Breastfeeding is one of the highest impact interventions in terms of meaningful and sustained health benefits for mothers and infants (Hansen, 2016). The potential contribution of a father to breastfeeding has long been ignored or dismissed. However, given the growing international evidence base supporting paternal involvement in breastfeeding, it is important that breastfeeding research in Ireland acknowledge this and depict the experience of breastfeeding from the perspectives of mothers *and* fathers.

1.4 Diet and supplementation practices in infancy

This section moves beyond breastfeeding to examine the influences of complementary feeding and vitamin D supplementation on healthy infant development. When exploring complementary feeding practices, it is important to consider not only nutritional intakes, but also the: age at which complementary foods are introduced; progression of complementary feeding; and maternal infant feeding style (McPhie *et al.*, 2014; Alvisi *et al.*, 2015). Therefore, this section will examine the research to date on these aspects of feeding alongside assessing vitamin D supplementation practices in infancy.

1.4.1 Timing of complementary feeding

Complementary feeding, also referred to as *weaning* in this thesis, is the introduction of foods other than breast milk or formula milk into the infant diet (Agostoni *et al.*, 2008). As an infant nears six months of age, the volume of milk consumed becomes insufficient to meet their nutritional needs, thus necessitating the introduction of additional sources of nutrition to support healthy growth and development (Kramer and Kakuma, 2004). The most recent recommendations for weaning on to complementary foods in Ireland state that most infants should be weaned close to 26 weeks of age (FSAI, 2011). These recommendations acknowledge that some infants are developmentally ready for complementary foods before this age, but unequivocally state that no infant should be weaned before 17 weeks of age (FSAI, 2011).

Introducing an infant to complementary foods before 17 weeks of age has been associated with an increased risk of respiratory illness, coeliac disease, constipation, faltering growth and obesity (Wilson *et al.*, 1998; Northstone *et al.*, 2001; Greer *et al.*, 2008; de Silva *et al.*, 2014). In light of these potential adverse health outcomes, the early introduction of complementary foods has received much attention in the literature and has previously been reported as a significant infant feeding issue amongst Irish mothers. For example, in 2008, Tarrant reported that in a sample of 401 Irish mothers, almost a quarter had introduced their infant to complementary foods at or before 12 weeks of age, and three-quarters had introduced their infant to complementary foods by 17 weeks of age. However, feeding practices appear to have much improved since the publication of this data, with recent representative studies reporting figures of 18.0% (O'Donovan *et al.*, 2015) and 15.5% (Dominguez Castro *et al.*, 2014) for the introduction of complementary foods before 17 weeks of age, rates which are well below the European average of 25.0% (Schiess *et al.*, 2010; Alvisi *et al.*, 2015).

Tarrant *et al.* (2010) reported that mothers who received advice from a public health nurse on the recommended age for weaning were significantly less likely to wean their infant prematurely. Furthermore, in the more recent study by O'Donovan *et al.* (2015), 52.0% of mothers cited advice from their public health nurse as the reason for commencing weaning at the time that they did, indicating that public health nurses continue to be an important source of weaning information for mothers. In light of the potential adverse consequences of early weaning, it is important that the measures currently in place to promote compliance with the recommended age of weaning are preserved, in order to see continued improvements in weaning practices from the outset.

1.4.2 Recommended food intakes during complementary feeding

Complementary feeding plays an essential role in meeting the changing nutritional needs of the developing infant (Conn *et al.*, 2009; Pearce and Langley-Evans, 2013). As an exclusively breastfed infant advances towards 26 weeks of age, the volume of breast milk consumed becomes insufficient to support his nutritional needs, with deficits occurring in the intakes of energy, protein, iron, zinc and vitamins A and D (Agostoni *et al.*, 2008). To meet these deficits, sources of nutrition beyond breast milk, or indeed formula milk, are needed, and thus complementary feeding must commence.

Once complementary feeding commences, breast milk and/or formula milk should continue to make a significant contribution to infant food intakes; however, it is important that a variety of complementary foods which represent the major food groups are also introduced, to ensure that the energy and nutritional requirements of an infant are fully met (Alvisi *et al.*, 2015). Infant energy requirements amount to approximately 72 kilocalories per kilogram per day (Scientific Advisory Committee on Nutrition, 2011; Alvisi *et al.*, 2015). Protein intakes should contribute approximately 10.0% of an infant's total energy need, carbohydrate intakes should contribute between 45.0% and 60.0% of total energy need, and fat intakes should contribute approximately 40.0% of total energy need (Alvisi *et al.*, 2015).

To meet these requirements, the complementary foods which should be prioritised include red meat and well-cooked eggs for their protein, iron and fat-soluble vitamin content, oily fish for its polyunsaturated fatty acid profile, fruits and vegetables for their fibre and water-soluble vitamin content, and cereals for their energy and fibre content (Agostoni *et al.*, 2008; FSAI, 2011; Alvisi *et al.*, 2015). Foods high in sugar and saturated fat should be kept to a minimum, as these foods can contribute to excess energy intakes (Alvisi *et al.*, 2015) and set the tone for less healthy taste preferences in the infant (Northstone *et al.*, 2001; Nicklaus *et al.*, 2005; Maier *et al.*, 2008; Butte, 2009; Horodynski *et al.*, 2011; Pearce and Langley-Evans, 2013; Alvisi *et al.*, 2015).

Infants generally prefer high-energy foods characterised by sweet and salty tastes (Agostoni *et al.*, 2008; Alvisi *et al.*, 2015). If this predisposition for energy-dense palatable foods is indulged as weaning progresses, it may result in unbalanced dietary intakes from the early stages of weaning (Agostoni *et al.*, 2008; Hetherington *et al.*, 2011). Therefore, it is important that caregivers prioritise the provision of foods which are without added sugar and salt (Agostoni *et al.*, 2008; FSAI, 2011; Alvisi *et al.*, 2015), in order to attenuate an infant's less taste preferences, and therefore to promote healthier weight gain, dental health and dietary variety in infancy (Ventura and Worobey, 2013).

Breast milk and/or formula milk and water are the fluids of choice throughout weaning (Alvisi *et al.*, 2015). Fruit juices and fruit drinks should ideally be avoided due to their cariogenic properties (FSAI, 2011; Alvisi *et al.*, 2015), and cow milk, being a poor source of iron, should not be consumed as a main milk drink until an infant turns 12 months of age (Agostoni *et al.*, 2008). Daily fluid intakes should be limited to 100 millilitres per kilogram, since excess fluid intakes will curb appetite and impede the consumption of a wider variety of textured foods (Alvisi *et al.*, 2015).

Upon the commencement of weaning, it is recommended that infants are introduced to purées which gradually become thicker in consistency. These purées should give way to foods of a lumpy mashed consistency and to soft finger foods by nine months of age. Between nine months of age and the end of the first year of life, infants should advance to foods of a minced and chopped consistency and to harder finger foods (FSAI, 2011). This progression towards increasingly advanced textures is important for the development of skills which enable an infant to consume foods independently (Coulthard *et al.*, 2009). Conversely, the prolonged consumption of purées has been associated with poorer oral-motor skills and decreased efficacy in chewing, possibly resulting in later feeding difficulties and reduced food variety (Skinner *et al.*, 2002; Cooke *et al.*, 2004; Mason *et al.*, 2005; Coulthard *et al.*, 2009).

Ultimately, the literature recommends that infants should become accustomed to a no-added-sugar and no-added-salt diet which consists of a variety of foods from the major food groups and which becomes increasingly more complex in texture as the infant becomes increasingly independent with feeding (FSAI, 2011).

1.4.3 Complementary feeding practices in Ireland

Infant food intakes during the early stages of weaning in Ireland have received considerable attention over the past decade (Tarrant *et al.*, 2010; Dominguez Castro *et al.*, 2014; O'Donovan *et al.*, 2015). The latter stage of weaning has received less attention, with the National Preschool Nutrition Survey (NPNS) (Irish Universities Nutrition Alliance [IUNA], 2012) being the main study which has provided important insights into diets at age one year. The participants in the NPNS were aged between 12 and 59 months, inclusive. However, the results were stratified by year, and so the data on one-year-olds represents the intakes of infants aged 12-23 months, inclusive.

The NPNS reported that one year old infants consumed approximately 1005 kilocalories per day (IUNA, 2012). Protein, fat and carbohydrate contributed 15.6%, 34.0% and 50.4% of total energy intakes, respectively, and milk was the most important contributor to total kilocalories consumed (IUNA, 2012). Micronutrient intakes were largely adequate, but almost a quarter of infants had inadequate iron intakes at age one year, and approximately three-quarters of one year old infants had suboptimal vitamin D intakes (IUNA, 2012). A third of one-year-olds consumed fruit juices and almost two in five consumed confectionary daily (IUNA, 2012). Therefore, one-year-olds were meeting their macronutrient needs, but some deficits in daily micronutrient intakes were detected, alongside some undesirable intakes of sweetened beverages and confectionary.

Although the NPNS provided valuable insights into dietary intakes between the ages of 12 and 23 months, further research is needed to obtain an understanding of the diets and eating skills of Irish infants as they are on the cusp of toddlerhood. Obtaining such data is important, since the dietary habits and feeding skills established in the first year of life underpin the dietary habits and feeding skills recorded in later childhood. Furthermore, investigation into dietary habits in infancy can help researchers to identify practices which provide the opportunity to intervene and positively influence longer-term dietary outcomes (McPhie *et al.*, 2014).

1.4.4 Maternal infant feeding style

While it is vital to know what dietary habits and feeding skills have been established in infancy, it is also important to understand *how* these habits and skills came to be.

Therefore, it is important to understand the strategies used to create an infant's feeding environment.

A mother is the person most often responsible for establishing the quality, quantity and timing of food available to an infant (Harrison *et al.*, 2011). Since a mother is the principal creator of her infant's first food environment, investigating the factors which influence how a mother chooses to feed her infant can provide insights into the early development of healthy or unhealthy eating behaviours in young children.

Maternal infant feeding style refers to the behavioural strategies employed by mothers to influence their infant's food intake (Gregory *et al.*, 2010). The most frequently investigated feeding style within the literature to date is a *controlling* maternal infant feeding style (McPhie *et al.*, 2014). A controlling feeding style has three main components: pressure to eat, restriction and monitoring (Birch *et al.*, 2001). Controlling feeding practices are also referred to as *non-responsive* feeding practices, because they fail to recognise, and appropriately respond to, an infant's internal cues of hunger (McPhie *et al.*, 2014). As such, it is thought that these practices ultimately disrupt an infant's ability to self-regulate their own food intake, potentially increasing the risk of undesirable weight gain (DiSantis *et al.*, 2011).

A recent systematic review stated that the factors which determine a mother's infant feeding style are complex and varied (McPhie *et al.*, 2014). Although some research has been conducted to explore the child health outcomes of maternal infant feeding style, most of this research has focused on the attitudes of older children towards foods which their mothers emphatically restrict or encourage (Birch and Fisher, 2000; Birch and Davidson, 2001). Such attitudes cannot be measured amongst infants, although efforts are being made to develop instruments which could provide insights into maternal infant feeding styles from the initial stages of complementary feeding (Brown and Lee, 2011).

Brown and Lee (2011) adapted the Child Feeding Questionnaire (CFQ) for use amongst mothers with an infant aged six months and older. The CFQ was originally developed to assess the feeding style of mothers with children aged two years of age and older (Birch *et al.*, 2001). Studies which have used the adapted instrument are limited, with only one published study (Brown and Lee, 2011) using it to report that mothers who employed a traditional approach to weaning appeared to exert more control over their infant's food intake than mothers who employed a baby-led approach to weaning. However, the study could not report on infant outcomes due to its cross-sectional nature, and therefore it is clear that further research is needed in this area.

Unfortunately, in addition to being limited, the data on infant feeding styles have been inconsistent, with controlling feeding styles being associated with increased food intake and weight (Fisher and Birch, 1999; Campbell *et al.*, 2006), decreased food intake and weight (Fisher *et al.*, 2002; Galloway *et al.*, 2005; Galloway *et al.*, 2006; Crouch *et al.*, 2007) and with having no effect on food intake and weight (Spruijt-Metz *et al.*, 2002; Kröller and Warschburger, 2008; Musher-Eizenman *et al.*, 2009).

Therefore, much remains to be understood about how a mother's attitudes and behaviours shape her infant's early food environment. Without an understanding of the influences which underpin the development of eating habits in infancy, it is more difficult to understand eating habits in toddlerhood and later childhood (Farrow and Blissett, 2008). Therefore, there is a need to further investigate the associations between infant outcomes and maternal infant feeding style, in addition to investigating maternal parenting style, temperament and psychopathology, which may provide insights into why a mother chooses the infant feeding style that she does (McPhie *et al.*, 2014).

1.4.5 Vitamin D supplementation in infancy

While an infant's food intake should ideally meet all of their nutritional needs, one specific micronutrient has been identified as lacking in the diets of many infants in

Ireland (FSAI, 2007). Vitamin D is essential for healthy bone development (Gallo *et al.*, 2012), but vitamin D insufficiency and vitamin D deficiency in infancy have been identified in recent years (FSAI, 2007) resulting in the recommendation that all infants consume five micrograms of vitamin D by supplementation each day from birth to their first birthday (FSAI, 2007; Health Service Executive [HSE], 2010).

The chief functions of vitamin D are the regulation of calcium homeostasis and bone mineral metabolism (IOM, 2010; Gallo *et al.*, 2016). Over the lifespan, the most accelerated rates of growth and bone mineral accretion occur in infancy (Gallo *et al.*, 2012; Gallo *et al.*, 2016), with evidence indicating that maximising bone accretion during this time benefits bone health at later stages of the life cycle (Cooper *et al.*, 2002; Gallo *et al.*, 2012; Holroyd *et al.*, 2012). Therefore, a deficiency of vitamin D during this time will negatively affect bone health, with prolonged deficiency resulting in bone demineralisation. As such, vitamin D supplementation is recommended in infancy to reduce the incidence and severity of vitamin D deficiency (FSAI, 2007).

However, although the recommendation to supplement all infants with five micrograms of vitamin D each day from birth to their first birthday (FSAI, 2007) was implemented by the Health Service Executive in 2010 (HSE, 2010), no study to date has examined compliance with this recommendation. Investigation into compliance with this recommendation and, if needed, into strategies which improve compliance, should be prioritised as part of the effort to safeguard infant bone health (Patience, 2015).

1.4.6 Directions for research on diet and supplementation practices in infancy

Infant feeding experiences can have far-reaching consequences on health (Butte, 2009), and so this phase of feeding has received much attention in the literature. In particular, the characteristics of early feeding practices have been examined, particularly in terms of the age at which weaning commences (Allcutt and Sweeney, 2010; Tarrant *et al.*, 2010; Dominguez Castro *et al.*, 2014) and the appropriateness of the foods consumed

(Tarrant *et al.*, 2010; IUNA, 2012; O'Donovan *et al.*, 2015). However, with only one large study (IUNA, 2012) published to date on nutrient intakes towards the end of the first year of life, this is a phase of the weaning process which could benefit from further investigation. Therefore, a comprehensive investigation into the dietary habits and feeding skills acquired by the age of one year is needed in Ireland, in order to better understand how to advise parents on positive feeding practices as their infant moves into toddlerhood and early childhood. In order to be truly comprehensive, this investigation should target not only dietary intakes, but also maternal infant feeding styles and compliance with recommended vitamin D supplementation practices.

1.4.7 Conclusions on diet and supplementation practices in infancy

Recommendations state that infants should be introduced to complementary foods close to six months of age and that the process of transitioning to family foods should be complete by 12 months of age. Complementary feeding is a time when food intakes can be heavily manipulated according to a primary caregiver's wishes (Brown and Lee, 2011), and therefore it is important to consider the infant feeding behaviours of carers when interpreting infant food intakes and devising infant feeding guidance for parents. Although improvements have been seen in certain aspects of complementary feeding over the past decade, continued close scrutiny of this time is needed in order to identify opportunities to influence an infant's food environment as positively as possible.

1.5 Influences on infant growth patterns

This review of the literature will now progress beyond influences on infant diet to examine influences on infant growth. In 2013, the nationally representative Growing Up in Ireland study reported that children who had a rate of growth in infancy which exceeded World Health Organisation (WHO) standard trajectories were more likely to be overweight or obese at age three years (Williams *et al.*, 2013). Therefore, weight status and weight gain patterns in infancy are strongly predictive of body mass index

(BMI) and other measures of obesity in later childhood (Eriksson *et al.*, 2008). Unfortunately, once established in infancy, overweight and obesity tend to persist into childhood, adolescence, and even adulthood (Botton *et al.*, 2008; Chomtho *et al.*, 2008; Ong *et al.*, 2009; Stettler and Iotova, 2010). It is now clear that a positive tracking period for adult overweight and its associated negative health outcomes, such as cardiovascular disease and Type II diabetes mellitus, can begin as early as foetal development in pregnancy and the first two years of life (Eriksson *et al.*, 2003; Eriksson *et al.*, 2006; Belfort *et al.*, 2007; Ekelund *et al.*, 2007; Singhal *et al.*, 2007; Norris *et al.*, 2012). These long-term adverse consequences of unhealthy growth patterns in infancy make the identification of factors which influence these patterns an important element of population health research.

However, infant growth is a complex and not fully understood mechanism which is influenced by genetic traits, intrauterine influences and environmental factors (Bergmann *et al.*, 2003; Dattilo *et al.*, 2012; Casazza *et al.*, 2013; van den Berg *et al.*, 2013; Carling *et al.*, 2015). For the majority of infants whose weight gain exceeds WHO standard trajectories, their pattern of rapid weight gain can be attributed to the interaction between multiple genetic factors and an accommodating environment (Mutch and Clement, 2006; Stettler, 2007; Maziak *et al.*, 2008; Skidmore *et al.*, 2009; Berthoud *et al.*, 2011). The following sections will highlight some of the maternal and infant characteristics which are commonly associated with rapid weight gain and an elevated percentage body fat in infancy.

1.5.1 Identifying rapid weight gain in infancy

The definition of rapid growth in infancy has varied considerably in the available literature (Monteiro and Victoria, 2005). While linear measurements of weight gain have been used to identify rapid growth (Tanaka *et al.*, 2001; Stettler *et al.*, 2002), it is now accepted that simple weight gain is insufficient to assess growth (Monteiro and

Victoria, 2005; Oyama *et al.*, 2009). The use of a weight-for-length (WFL) index, such as ponderal index, is now recommended (Monteiro and Victoria, 2005), since such a measure can provide insight into infant weight gain patterns whilst taking length and gender into consideration (Oyama *et al.*, 2009; Mihrshahi *et al.*, 2011).

A standard deviation (SD) of 0.67 is equivalent to the distance between adjacent centile lines on standard WHO growth curves, *i.e.* 2nd, 9th, 25th, 50th, 75th, 91st and 98th centile lines (Ong *et al.*, 2000; Monteiro *et al.*, 2003; Oyama *et al.*, 2009). Clinically relevant rapid weight gain is indicated when the change in WFL *z*-score between two ages exceeds 0.67 SD (Ong *et al.*, 2000; Ong and Loos, 2006). Once the definition for rapid growth has been determined, factors associated with a growth pattern in which centile lines are crossed can be investigated.

1.5.2 Influences of maternal and infant characteristics on infant weight gain

Since growth in early life is influenced by many factors, known and unknown, it is challenging to isolate the effect of individual factors on growth (Appleyard *et al.*, 2005; Carling *et al.*, 2015). This is because factors which may exacerbate (*e.g.* smoking during pregnancy and lower maternal education) or attenuate (*e.g.* breastfeeding and higher maternal education) the tendency towards rapid growth often cluster together (van Rossem *et al.*, 2009). Therefore, the *cumulative effect* of risk factors for rapid growth is often more important than the impact of any one factor taken alone (Appleyard *et al.*, 2005; Gunnarsdottir *et al.*, 2010).

Several factors associated with rapid weight gain include: socioeconomic status (SES); maternal smoking; parental BMI; birth weight; and infant feeding practices. The associations between these factors and infant growth will be explored in this section.

Maternal socioeconomic status and rapid weight gain in infancy

Factors which comprise SES, *i.e.* education, income and social class, have been associated with rapid weight gain in infancy.

Infants whose mothers are socioeconomically disadvantaged are significantly more likely to experience rapid weight gain in the first year of life when compared with infants of socioeconomically advantaged mothers. A number of large longitudinal studies (Valerio *et al.*, 2006; Wijlaars *et al.*, 2011) have reported this association, including the National Child Development study (Teranishi *et al.*, 2001), Stockholm Weight Development study (Ekelund *et al.*, 2006), Amsterdam Born Children and their Development study (van den Berg *et al.*, 2013) and the Growing Up in Ireland study (Layte and McCrory, 2014).

From socioeconomic disadvantage stems a number of suboptimal health behaviours and infant feeding practices which in turn increase the likelihood of rapid weight gain in infancy. Socioeconomically disadvantaged mothers are often more likely to smoke in pregnancy (Laaksonen *et al.*, 2005; van den Berg *et al.*, 2013; Layte and McCrory, 2014), less likely to breastfeed (Tarrant *et al.*, 2009; Brick and Nolan, 2014; Layte and McCrory, 2014; Gallagher *et al.*, 2015) and less likely to wean according to recommended practice (Dubois and Girard, 2006; Tarrant *et al.*, 2010).

Therefore, while low SES itself does not cause rapid weight gain, the parenting behaviours and practices which are more commonly found in a population which meets the definition of low SES are more likely to precipitate rapid weight gain in infancy.

Maternal smoking status and rapid weight gain in infancy

Smoking during pregnancy has been consistently associated with rapid growth in infancy and an increased risk for overweight in later life (Oken *et al.*, 2008). This association has been shown to persist despite adjustment for SES, gestational weight gain, parental BMI and infant feeding behaviours (Layte and McCrory, 2014).

The longitudinal Growing Up in Ireland study reported that infants born to women who had smoked heavily in pregnancy were 85.0% more likely to grow rapidly in infancy compared to infants whose mothers abstained from smoking in pregnancy

(Layte and McCrory, 2014). Furthermore, the adverse effects of antenatal smoking on growth extend beyond infancy (Bergmann *et al.*, 2003; Al Mamun *et al.*, 2006; Chen *et al.*, 2006; Dubois *et al.*, 2007). A systematic review and meta-analysis by Oken *et al.* (2008) reported that the offspring of women who smoked during pregnancy were 1.5 times more likely to be overweight in childhood. Furthermore, data from the National Child Development Study (Power and Jefferis, 2002) indicate that this adjusted risk persists into adulthood, with analyses indicating that adults whose mother had smoked in pregnancy were 1.5 times more likely to be obese at age 33 years, when compared to those adults whose mothers did not smoke in pregnancy.

Therefore, it is evident that foetal exposure to cigarette smoke throughout the antenatal period has lifelong profoundly adverse consequences for physical health. The mechanism by which smoking in pregnancy programmes weight gain patterns has not been fully elucidated (Oken *et al.*, 2008; Carling *et al.*, 2015). However, it is thought that exposure to nicotine, which crosses the placenta, affects both the central and peripheral nervous systems of the foetus and therefore affects the regulation of appetite and body weight. Additionally, the subsequent nicotine withdrawal in the infant on birth may result in hyperphagia and a deranged appetite, thus increasing the tendency to gain excess weight (Li *et al.*, 2000). Therefore, with such a wealth of evidence supporting the adverse consequences of antenatal smoking for mother and infant, it is important that health campaigns which encourage women to desist from smoking, especially in pregnancy, continue to be given priority (Layte and McCrory, 2014). The health and economic value of providing additional growth monitoring to the infants of mothers who smoked throughout pregnancy could also warrant investigation.

Parental BMI, infant birth weight and rapid weight gain in infancy

Maternal weight status has been consistently correlated with infant weight (Dattilo *et al.*, 2012). Women who have an obese BMI or who gain excessive weight during pregnancy are more likely to give birth to infants who are large for their gestational age, compared to women of a healthy weight (Danielzik *et al.*, 2002; Salihu *et al.*, 2009). Infants who are large for their gestational age have been reported to be at a higher risk of becoming obese toddlers (Oken *et al.*, 2007) and children (Dubois and Girard, 2006; Salihu *et al.*, 2009; Wrotniak *et al.*, 2008; Wright *et al.*, 2009; Lamb *et al.*, 2010), although not all studies have confirmed this association (Stunkard *et al.*, 1999).

Although causality for this association has not been unequivocally established (Dattilo *et al.*, 2012), it is thought that excess maternal gestational weight gain *in utero* may precipitate endocrine and other biologic disruptions which may contribute to the problem of obesity in later life (Newbold *et al.*, 2007; Oken *et al.*, 2007; Gillman *et al.*, 2008; Lamb *et al.*, 2010).

Therefore, guidance on weight gain which is within the recommendations made by the Institute of Medicine (2009) should be provided to expectant mothers (FSAI, 2011; Dattilo *et al.*, 2012), but it has been reported that many women are unaware of these recommendations (Whitaker *et al.*, 2016). Additionally, it must be noted that the initiation of dietary change throughout pregnancy is often challenging (Anderson, 2001; Chang *et al.*, 2015), particularly if nutritional issues such as vomiting, nausea and food cravings are present. Therefore, it would be more helpful to the weight gain outcomes of infants if positive modifications to maternal weight, diet and lifestyle were made prior to conception (Dattilo *et al.*, 2012; Whitaker *et al.*, 2016).

Infant feeding practices and rapid weight gain in infancy

Breastfeeding confers many benefits to the health outcomes of an infant, including enhanced immunity and decreased risk of gastrointestinal infections, respiratory infections and asthma (Kramer and Kakuma, 2004; Horta *et al.*, 2007). Furthermore, while most studies show some degree of inverse association between rapid weight gain and breastfeeding (Arenz *et al.*, 2004; Owen *et al.*, 2005; Quigley, 2006; Beyerlein *et* *al.*, 2008), the relationship between breastfeeding and later obesity is less conclusive. From a research perspective, the interpretation of the relationship between breastfeeding and subsequent rapid weight gain is clouded by inconsistencies in the definitions of breastfeeding and rapid weight gain and in the measures of breastfeeding duration and length of participant follow-up (Dattilo *et al.*, 2012).

A clear example of the challenges in interpreting the relationship between breastfeeding and weight gain in infancy is evident in the nationally representative Growing Up in Ireland study (Layte and McCrory, 2014). This study reported that although *not* breastfeeding was associated with a greater likelihood of rapid growth, a dose-response relationship was not evident, *i.e.* exclusive breastfeeding and breastfeeding for a longer duration were not associated with lower odds of rapid weight gain. The authors posited that this may be because breastfeeding is a proxy for an unmeasured factor associated with healthier infant weight gain, or that there are complex relationships at play between the various characteristics included in the model which have not been elucidated (Layte and McCrory, 2014).

The Growing Up in Ireland study also found that the commencement of weaning before 17 weeks of age was associated with a 59% increased likelihood of rapid weight gain (Layte and McCrory, 2014). This relationship between early weaning (*i.e.* weaning before 17 weeks of age) and rapid weight gain has been reported elsewhere (Baker *et al.*, 2004; Ong *et al.*, 2006; Brophy *et al.*, 2009). Breastfeeding decreases the likelihood of early weaning (Layte and McCrory, 2014), so it is possible that the cumulative effect of these factors may attenuate the tendency towards rapid weight gain.

As mentioned previously, it can be challenging to isolate the effect of individual factors on growth. Breastfeeding often occurs in conjunction with other behaviours which reduce the likelihood of rapid weight gain (Dattilo *et al.*, 2012), such as the timely commencement of weaning, and so although causality between breastfeeding and a reduced likelihood of rapid weight gain remains to be fully demonstrated, there is a consensus that breastfeeding has some protective role in paediatric obesity (Dattilo *et al.*, 2012).

This section has examined some common factors associated with weight gain patterns in infancy. The factors examined here are clearly important to weight gain patterns, and therefore data should be collected on these factors in any study examining infant growth. However, despite the research amassed on the topic of infant growth to date, it is essential to recognise that the determinants of rapid weight gain in infancy are highly challenging to elucidate. The Growing Up in Ireland study is the largest nationally representative study to date which has investigated the growth of infants in Ireland. The adjusted analysis of the determinants of rapid growth in infancy in this study included a model with 17 variables, which in turn encompassed 90 subcategories. These categories represented data on maternal sociodemographic and health behavioural characteristics, pregnancy complications, infant anthropometry and infant feeding. Despite the inclusion of many factors which have been associated with rapid growth in infancy, the final model explained only 19.0% of the variance in rapid growth (Layte and McCrory, 2014). Therefore, it is clear that there are other unmeasured and unknown factors which influence rapid weight gain in infancy, and although this aspect of infant health has attracted much attention, more work remains to be done to further unravel the complex mechanisms which underlie rapid infant growth. Such work could include a comprehensive study of not only environmental influences on growth outcomes, but also the genetic and epigenetic influences on infant growth which are contributed by both parents.

1.5.3 Influences on, and consequences of, body composition in infancy

Infant body composition is a subject in which there is growing interest, as percentage fat mass at birth has been reported to be a sensitive biomarker of abnormal development *in* *utero* (Catalano *et al.*, 2003). It is thought that percentage body fat at birth may be an antecedent for later obesity (Ma *et al.*, 2004), and that it is a better indicator of *quality* of infant growth when compared with birth weight alone (Pereira-da-Silva *et al.*, 2014).

The accurate measurement of body composition in the first six months of life has been made possible by the use of the gold standard technique known as air displacement plethysmography (Ma *et al.*, 2004). This technique was used to determine normative values for percentage body fat at birth amongst Irish infants (Hawkes *et al.*, 2011). This is the first study to determine such values amongst a large cohort of infants, where percentages of body fat at birth amongst males, females and the full sample of 743 infants were reported to be 9.8%, 11.9% and 10.8%, respectively.

Given that a mother provides the intrauterine environment in which a foetus develops, it is expected that an infant's body composition at birth will reflect the physical condition of his mother during pregnancy (Dattilo *et al.*, 2012). As such, some maternal characteristics prior to the birth of an infant have been associated with a higher percentage body fat in the infant, such as gestational diabetes (Catalano *et al.*, 2003; Sewell *et al.*, 2006) and an overweight or obese BMI (Hull *et al.*, 2008; Pereira-da-Silva *et al.*, 2014; O'Connor *et al.*, 2015). However, these studies have been relatively small preliminary investigations which have employed different methods to assess infant body composition, making the interpretation of the data presented more difficult. Although further research is needed, these studies do consistently report an association between undesirable maternal health characteristics and higher percentage body fat at birth.

Infant birth weight has been unequivocally associated with later health outcomes (Barker *et al.*, 2002; Barker *et al.*, 2006; Eriksson *et al.*, 2006). It is reasonable to assume that the lean and fat tissues which contribute to infant weight may also play a role in later health outcomes. However, although normative values for percentage body fat at birth have been reported (Hawkes *et al.*, 2011), no study to date has established an "ideal" percentage body fat at birth or at any other time throughout the first year of life, nor has any study identified the long-term health implications of percentage body fat in infancy.

With the advent of accurate measures of body composition in early infancy, researchers now have the opportunity to explore a potentially critical facet of infant growth *in utero*. New insights into factors associated with this aspect of infant growth could pave the way for more effective health promotion amongst pregnant women and for more effective and tailored monitoring of infant growth from birth.

1.5.4 Directions for research on infant growth and body composition

Although infant growth is an area which has been extensively researched, questions still remain over factors which affect growth patterns in the first year of life. Therefore, given the potentially lifelong implications of undesirable growth patterns in infancy, it is an area worthy of continued investigation.

Furthermore, since early investigations into infant body composition indicate that percentage body fat at birth may be linked to future health outcomes, this too is an area which deserves more attention as part of the effort to provide a more comprehensive understanding of the factors affecting infant growth from as early as the first weeks of pregnancy.

1.5.5 Conclusions on infant growth and body composition

The optimisation of infant growth *in utero* and throughout infancy could lead to substantial reductions in adverse health outcomes in later life (Taveras *et al.*, 2009; Askie *et al.*, 2010). A multitude of known and unknown genetic, biologic and antenatal factors influence infant growth (Dattilo *et al.*, 2012), and continued investigation into such factors is needed in order to elucidate modifiable factors which may contribute to positive growth outcomes. Given the plasticity of growth throughout pregnancy and infancy, this period may represent the most critical window of opportunity in which interventions can have the most profound impact in preventing unhealthy weight gain patterns across the infant population.

1.6 Research gaps which this thesis will aim to address

From this review of the literature, this thesis has identified several opportunities for further research, some of which are within the scope of this thesis to feasibly address.

As already outlined in **section 1.2**, there has been little assessment of the association between maternal wellbeing and breastfeeding outcomes in the Irish literature. Therefore, **chapter four** outlines the research conducted to investigate this association in order to obtain a baseline understanding of wellbeing amongst breastfeeding mothers in Ireland.

Furthermore, **chapter seven** of this thesis outlines the research conducted to gain novel insights into the knowledge and attitudes of fathers in Ireland towards breastfeeding. As outlined in **section 1.3**, this is another aspect of the literature on breastfeeding in Ireland which has received almost negligible attention to date. In light of its importance to breastfeeding behaviours, however, this is a topic which needs and deserves attention.

This thesis will also investigate the factors associated with infant dietary intakes. As outlined in **section 1.4**, this is an area which has received considerable attention in Ireland to date. However, there are facets of the infant diet which require investigation, and these include infant dietary intakes at age one, maternal infant feeding style and compliance with recommended vitamin D supplementation practices. The research conducted to investigate these aspects of infant feeding is outlined in **chapter five**.

Finally, **section 1.5** identified several areas for further research on aspects of infant growth, particularly in terms of infant body composition at birth and at age one year. Therefore, **chapter six** outlines the work conducted to add to the literature on growth patterns in infancy and body composition at birth and 12 months of age.

1.7 Conclusion

The year before, and the year after, the birth of an infant represent a substantial transition during which the health and wellbeing of mother, father and infant are profoundly affected. This chapter has explored the literature in relation to maternal and paternal influences on infant diet and growth and has thus highlighted that parenting decisions during this time can reverberate throughout the lifecycle of the infant, influencing their physical and emotional health outcomes. Therefore, this thesis aims to contribute to our understanding of how the health behaviours of mothers, infants and fathers interact with, and influence, one another, thus setting the tone for future family health outcomes.

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CHAPTER 2 Aims, objectives and general methodology

The methods described in this chapter apply to the results outlined in **chapters three**, **four**, **five**, **six** and **seven**. All work presented in this thesis was conducted solely by the author, thereby precluding the potential for any inter-observer error.

2.1 Aims and objectives

This research aimed to investigate maternal and paternal influences on infant diet and growth in the first year of life. Specifically, the objectives were to:

- Examine factors associated with maternal wellbeing in pregnancy and at four months post-partum;
- Explore the association between maternal wellbeing and breastfeeding outcomes;
- Explore the weaning diet at 12 months post-partum;
- Assess the association between maternal feeding style and infant diet at 12 months post-partum;
- Compare vitamin D supplementation practices for infants with supplementation recommendations throughout the first year of life;
- Assess infant growth and body composition throughout the first year of life;
- Assess the utility of devices used to measure infant body composition; and
- Explore the paternal experience of having a breastfeeding partner.

2.2 Ethical approval

Ethical approval was obtained from three institutions.

First, ethical approval was obtained from the Coombe Women and Infants University Hospital (CWIUH) to cover contact made with participants in pregnancy, at birth, and during home visits at four and nine months post-partum.

Second, ethical approval was obtained from Our Lady's Children's Hospital, Crumlin, to cover the home visit with participants at 12 months post-partum.

Finally, ethical approval was obtained from Dublin Institute of Technology to cover all elements of the study.

It took approximately 14 months to obtain ethical approval from all three institutions, and a number of stipulations were put in place by these ethics committees. The most pertinent stipulations are listed below.

- Recruitment of participants was restricted to community-based public antenatal clinics and semi-private antenatal clinics. This was due to the limited space in the public antenatal clinics on the main grounds of the CWIUH.
- To comply with the National Infant Feeding Policy for Maternity and Neonatal Services (Health Service Executive [HSE], 2012), pregnant women could not be questioned on their milk feeding intentions.
- Personal information (*e.g.* addresses, phone numbers and details of next-of-kin) could not be verbally requested in antenatal clinics due to a lack of privacy. However, this information could later be obtained from a patient's medical file.

2.3 Study design

There were two study designs used in the course of this research.

Firstly, the main body of research involved a prospective observational study. Recruitment of pregnant women and follow-up of mother-infant dyads took place between September 2013 and November 2015. The methods used to recruit and follow-up participants are outlined in **sections 2.4 to 2.10**. There were five points of data collection:

1. In pregnancy, after 24 weeks gestation;
2. During the hospital stay after birth;
3. At four months post-partum;
4. At nine months post-partum; and
5. At 12 months post-partum.

Secondly, a cross-sectional semi-quantitative questionnaire was posted to men who had become fathers, for a first or subsequent time, to infants born in the CWIUH over the previous four to seven months. The procedure for issuing these questionnaires is described in **section 2.11**.

2.4 Study settings

2.4.1 Recruitment settings

Convenience sampling was used during recruitment. Participants were CWIUH patients who were recruited from community-based public antenatal clinics in Tallaght (County Dublin) and Naas (County Kildare), and from on-site semi-private antenatal clinics.

2.4.2 Follow-up settings

Participants were followed-up on the ward in the CWIUH after giving birth.

Subsequently, participants were followed-up in their homes at four, nine and 12 months post-partum. Most participants lived in counties Dublin, Kildare and Wicklow. Home visits took place on weekdays, including evenings, and on Saturdays. The average visit lasted approximately 1.5 hours.

2.5 Recruitment

2.5.1 Characteristics of the population available for recruitment

The CWIUH has approximately 8,500 live births each year. Of the women attending the CWIUH, approximately 77%, 11% and 12% attend the public, semi-private and private antenatal clinics, respectively (Coombe Women and Infants University Hospital [CWIUH], 2013). In this study, patients who attended the community-based public antenatal clinics or the semi-private antenatal clinics were eligible for recruitment.

To attend the community-based public antenatal clinics of the CWIUH, a woman must register with the hospital before 14 weeks gestation, speak English, and have no health risk factors that require early assessment by a consultant. Approximately

1,100 Caucasian women of Irish or British nationality attend antenatal clinics in Tallaght (County Dublin) and Naas (County Kildare) annually.

To be eligible to attend the semi-private antenatal clinics, a woman must have private health insurance.

2.5.2 Inclusion criteria for study recruitment

Women were eligible to participate in the study if they had a healthy singleton pregnancy of at least 24 weeks gestation. Due to the small sample size of the study, women also had to be Caucasian and of Irish or British nationality to limit ethnic- and culturally- mediated confounding.

2.5.3 Recruitment strategy

The researcher attended semi-private antenatal clinics on Mondays and Fridays. The community-based antenatal clinic in the Mary Mercer Health Centre in Tallaght was attended on Tuesdays. The largest community-based antenatal clinics, in Naas General Hospital, were attended on Wednesdays and Thursdays.

Since clinics were relatively small, the researcher took steps to optimise the number of women recruited from each clinic. Such steps included obtaining a list of patients due to attend the clinic and determining the number of eligible pregnant women from that list. The researcher added the appointment time, gestational age and due date of each eligible pregnant woman to the list to help her to identify these women when they attended the clinic.

In the clinic, eligible women were approached and the study was explained (Appendix 1). To help prevent prospective participants from feeling overwhelmed by the duration of the study, they were not asked to commit to the full study at this stage. Instead, prospective participants were asked to participate in the first two contact points of the study, *i.e.* to complete a questionnaire while waiting in the antenatal clinic and to consent to the researcher measuring their baby during their hospital stay after birth.

Women who agreed to this signed a consent form (Appendix 2) on which a unique identification (ID) number was recorded. This ID number was subsequently used on all records containing information on that particular participant.

2.5.4 Non-participants

If a pregnant woman declined to participate in the study, the researcher documented her name and hospital number and did not request any personal information in the clinic.

However, to allow comparison with responders (Shepherd *et al.*, 1998), information on non-responders (Appendix 3) was later obtained from their medical files. Data collected on non-responders included:

- Marital status;
- Educational attainment;
- Type of medical insurance;
- Smoking status;
- Pattern of folic acid supplementation; and
- Whether or not their pregnancy was planned.

Data were also collected from the files of infants born to non-responders, to include: gestational age, gender, weight, mode of delivery, first milk and feeding method on discharge.

2.6 Contact in pregnancy

2.6.1 Logistics of obtaining data in pregnancy

Once written consent was obtained, participants were asked to complete a questionnaire (Appendix 4). Participants were asked to answer as many questions as possible and to put a line through any question that they were unwilling to answer. The questionnaire took approximately ten minutes to complete, and the researcher remained in the clinic to provide clarification on any aspect of the questionnaire.

Upon completion of the questionnaire, the researcher checked that all questions which participants were willing to answer had been answered. In thanks, each participant was given a copy of *"The First 1000 Days"* recipe book (Danone Nutricia Early Life Nutrition, 2013) and a checklist for her hospital bag (Appendix 5).

Due to the lack of privacy in antenatal clinics, personal information was not requested. Instead, relevant personal information (*e.g.* date of birth, contact number, address and next-of-kin) was later recorded (Appendix 6) from medical files.

2.6.2 Questionnaire in pregnancy

All questions were closed questions written according to plain English guidelines (National Adult Literacy Agency [NALA], 2011). The questionnaire had three sections.

1. Diet and lifestyle
    - Supplementation: The dose, frequency and duration of folic acid supplementation were recorded, in addition to other supplements consumed.
    - Smoking status: The numbers of cigarettes smoked each day before and during pregnancy were recorded. To calculate pack years, the length of time over which a participant ever smoked was also recorded.
    - Alcohol consumption: The frequency of alcohol consumption and the average number of alcoholic beverages consumed on each drinking occasion before and during pregnancy were recorded. Units of alcohol were assigned as follows: one pint of beer was 2.0 units; one glass of wine was 1.5 units; one bottle of beer was 1.0 unit; one measure of spirits was 1.0 unit; and one bottle of alcopops was 1.0 unit (Health Research Board [HRB], 2012).

2. Wellbeing in pregnancy

    Three validated tools were used to assess factors which may affect a participant's experience of pregnancy.

The validated 16-item **Tilburg Pregnancy Distress Scale** (TPDS) (Pop *et al.*, 2011) measured stress in pregnancy and perceived partner involvement. This pregnancy-specific scale measures distress over the previous seven days, and the overall scale is comprised of two subscales. The *negative affect* subscale of the TPDS measures distress with respect to confinement, the post-partum period and general health, *e.g.* ‘the delivery is troubling me’. The *partner involvement* subscale measures distress with respect to perceived partner involvement during pregnancy, *e.g.* ‘I can really share my feelings with my partner’. Participants rated on a four-point scale how often they felt as described by each item of the TPDS. Possible responses ranged from *very often* (score of 1) to *rarely or never* (score of 4). Items numbered 3, 5, 6, 7, 9, 10, 11, 12, 13, 14 and 16 on the scale were reverse-scored. Cut-off scores for distress were >17 for the *overall* scale, >12 for the *negative affect* subscale and >7 for the *partner involvement* subscale.

A validated 8-item short version (version 8b) of the **Body Shape Questionnaire** (BSQ) (Evans and Dolan, 1993) measured body shape concern over the previous seven days. Participants rated on a six-point scale how often they felt as described by each item of the scale, *e.g.* ‘Have you worried about your flesh being dimply?’, with possible responses ranging from *never* (score of 1) to *always* (score of 6). The minimum score was 8 and the maximum score was 48. Scores for degrees of body shape concern were: <19 for *no concern*; 19-25 for *mild concern*; 26-33 for *moderate concern*; and >33 for *marked concern*.

The 14-item **Resilience Scale** (RS-14) (Wagnild and Young, 1993) measured resilience, confidence and ability to persevere. Resilience refers to ‘emotional stamina’, and a resilient person is one who displays courage and adaptability in the face of life’s misfortunes and challenges (Wagnild and

Young, 1993). The RS-14 is a validated shortened version of the original 25-item Resilience Scale. The RS-14 is strongly correlated (r=0.97) with the original 25-item scale, has high internal consistency reliability (alpha coefficient of 0.93), and takes about half the time to complete compared to the original scale. Taking these characteristics into account, alongside the time constraints for questionnaire completion in the antenatal clinic, the RS-14 was deemed to be the most appropriate version of the Resilience Scale for use in this study.

To complete the RS-14, participants used a seven-point scale to indicate their agreement with each item of the scale, *e.g.* 'My belief in myself gets me through hard times', with agreement ranging from *strongly disagree* (score of 1) to *strongly agree* (score of 7). The minimum score on this instrument was 14 and the maximum score was 98. The cut-off scores used in this study were ≤73 for *low resilience* and ≥74 for *moderate/high resilience*.

3. Household and sociodemographic status

   The data collected included: accommodation type; net weekly income; deprivation level; maternal and paternal employment status and occupation; and maternal and paternal education level.

2.7 Contact made during the hospital stay after the birth

2.7.1 Logistics of obtaining data in hospital

The researcher kept lists, by month, of the participants due to give birth. Each morning (Monday-Sunday) at approximately 7am, a list of the deliveries in the previous 24 hours was checked by the researcher in the CWIUH. A term infant is one born between 37 and 42 weeks gestation, so the participants due within a five week period were checked against the list of deliveries each morning.

The researcher re-introduced herself to participants who had delivered an infant and been transferred to a ward. A suitable time to take infant measurements was arranged. Since measurements were taken in a separate room off the ward, and took approximately 20 minutes, mothers were invited to accompany the researcher.

Factors competing with the timely measurement of infants included: the rounds made by doctors and midwives; the need to shortly feed, change or wash infants; the presence of visitors; and the unavailability of the room needed for measurements. If an infant was not measured before discharge, no further follow-up took place.

2.7.2 Inclusion criteria for measurement in hospital

Healthy term (37-42 weeks gestation) infants delivered to healthy mothers who were still willing to have their infant measured were eligible for measurement in hospital.

2.7.3 Data obtained on the mother and infant during the hospital stay

The type of delivery, feeding method initiated, time of birth, and each infant's gender and birth weight (Appendix 7) were recorded prior to measurement.

To obtain anthropometric measurements and body composition (Appendix 7), infants were divested of their clothes, vest and nappy.

Anthropometric measurements

A disposable paper medical tape (Henley's Medical Supplies Ltd., Hertfordshire, United Kingdom [UK]) was used to measure the circumference of each infant's head, chest, abdomen, mid-arm and mid-thigh (Appendix 7). For all measurements, infants were in a supine position and the tape was held firmly but the skin was not compressed. All measurements were recorded to the nearest millimetre.

To measure head circumference, the tape was placed on the forehead, midway between the eyebrows and hairline, and fitted around the widest part of the back of the head over the occipital prominence. To measure chest circumference, the tape was placed midway between the infant's nipples and fitted around their chest whilst keeping the tape level. To measure abdominal circumference, the tape was placed just above the infant's navel and fitted around their abdomen whilst keeping the tape level. To measure mid-arm circumference, the tape was fitted midway between the olecranon process of the ulna and the acromion process of the scapula. To measure mid-thigh circumference, the measuring tape was fitted around the infant's thigh, midway between the trochanterion and the tibiale laterale.

Crown-heel length measurement

Length was measured with a calibrated seca 232 baby scales (seca GmbH & Co., Birmingham, UK) with a measuring rod with integrated head and foot positioners.

Infants were placed in a supine position with their head in contact with the head positioner and facing towards the ceiling in the Frankfort plane, *i.e.* that the imaginary line between the hole of the ear and the bottom of the eye socket was perpendicular to the platform of the foot positioner. Each infant's legs were gently straightened and the foot positioner was moved up to the soles of their feet. A gentle downward pressure was exerted on the soles of each infant's feet to ensure that they were resting flat against the foot positioner. Three measurements were read to the nearest millimetre and the average of these three figures was recorded (Appendix 7).

Weight measurement

Infant weight was recorded using a scales attached to the PEA POD air displacement plethysmography system (COSMED, Surrey, UK). These scales were calibrated in kilograms to four decimal places. Weight was measured in line with the manufacturer's (COSMED, Surrey, UK) instructions and recorded (Appendix 7).

Measurement of infant body composition

A PEA POD air displacement plethysmography system (COSMED, Surrey, UK) was used to assess body composition (fat and fat-free mass). It is suitable for use in infants weighing between 1-8kg and has been validated using reference techniques such as doubly-labelled water (Ma *et al.*, 2004).

Body composition was measured in line with the manufacturer's (COSMED, Surrey, UK) instructions, where infants were placed lying down within the calibrated chamber of the machine for 90 seconds. After 90 seconds, body composition measurements for that infant were automatically sent to a computer attached to the device. These measurements were documented by the researcher (Appendix 7), and the infant was re-dressed and returned to the ward.

The researcher plotted infant weight, length and head circumference using a United Kingdom-World Health Organisation (UK-WHO) gender-specific growth chart (Royal College of Paediatrics and Child Health [RCPCH], 2013a; RCPCH, 2013b).

The measurements taken were copied to an A5 keepsake card (Appendix 8) and explained to the infant's mother. Finally, mothers were asked if they were amenable to being contacted by the researcher at four months post-partum to arrange a home visit to assess their infant's growth, and they were thanked for their time.

2.8 Contact at four months post-partum

2.8.1 Arranging a home visit at four months post-partum

Mothers were contacted by phone approximately one week before their infant turned 17 weeks old. The following protocol for contacting mothers was used to arrange all home visits for the duration of the study.

If the researcher was unable to speak to a mother directly to arrange a visit, a voicemail was left. A text was also sent explaining who the researcher was and suggesting a day and time for a home visit, should that mother still be interested. If the researcher did not receive any contact from a mother, despite a voicemail and text, two days lapsed before the researcher called a second time.

If no contact was made on this second call, the researcher allowed a further day to lapse before calling a third and final time.

If no contact was made by phone, a final attempt at contact was made by posting a handwritten letter to the mother on CWIUH headed paper. The letter outlined the proposed visit, provided the researcher's contact details, and invited the mother to contact the researcher should she be interested in a home visit.

2.8.2 Inclusion criteria for a home visit at four months post-partum

Mothers whose healthy infants had been measured by the researcher at birth and who were amenable to a home visit were eligible for inclusion at four months post-partum.

2.8.3 Data obtained from mothers and infants at four months post-partum

A consent form (Appendix 9) was signed to allow the researcher to measure the infant and to obtain a completed quantitative questionnaire from mothers. Infants had their clothes and vest removed first to facilitate being measured (Appendix 10).

Anthropometric measurements at four months post-partum

A disposable paper medical tape (Henley's Medical Supplies Ltd.) was used to measure the circumference of each infant's head, chest, abdomen, mid-arm, and mid-thigh. Measurements were taken to the nearest millimetre, as outlined in **section 2.7.3**, and recorded (Appendix 10).

Crown-heel length measurement at four months post-partum

Infant length was measured using a *Rollametre by Raven* (Chasmors Ltd., London, UK), a non-stretch and non-shrink length board suitable for infants aged up to one year.

Each infant's nappy was removed. Infants were placed in a supine position with their head in contact with the head positioner and facing towards the ceiling in the Frankfort plane, *i.e.* that the imaginary line between the hole of the ear and the bottom of the eye socket was perpendicular to the platform of the foot positioner. The infant's legs were gently straightened and the foot positioner was moved up to the soles of their feet. A gentle downward pressure was exerted on the soles of each infant's feet to ensure that they were resting flat against the foot positioner.

Three measurements were read to the nearest millimetre and the average was recorded (Appendix 10).

Weight measurement at four months post-partum

With nappy still removed, infants were placed on to a calibrated seca 385 digital scales (seca GmbH & Co., Birmingham, UK) which was placed on a level surface. Weight was recorded in kilograms to two decimal places (Appendix 10). The scales used were calibrated using a standard one kilogram weight every six months.

Questionnaire at four months post-partum

While the researcher re-dressed the infant and plotted the infant's measurements using a gender-specific UK-WHO growth chart (RCPCH, 2013a; RCPCH, 2013b), mothers completed a quantitative questionnaire (Appendix 11). Most questions were closed questions which were written in plain English (NALA, 2011). The questionnaire was split into four sections as outlined below.

1. Milk feeding

   Information on milk feeding, including any transitions between types of milk feeding throughout the first four months post-partum, was obtained.

   Where relevant, the World Health Organisation (WHO) definitions of exclusive and partial breastfeeding were used to categorise milk feeding (World Health Organisation [WHO], 2004). Therefore, infants who were *exclusively breastfed* were those who were fed only breast milk. These infants were allowed to receive vitamins, minerals and medicine, but not water, breast milk substitutes, other liquids and solid foods (WHO, 2004). Infants who were *partially breastfed* were those who received breast milk in combination with breast milk substitutes and/or solid foods (WHO, 2004).

2. Supplementation

   Supplementation practices for both mother and infant were recorded, to include the type of supplements consumed and the frequency of their consumption.

3. Introduction of weaning foods

   If foods other than breast milk or infant formula had been consumed by the infant before four months post-partum, information on these foods was recorded, to include: the age of introduction; name of first food; current number of meals per day; and advice received from health professionals on weaning.

4. Health-related behaviours and wellbeing in the post-partum period

   Data on smoking status and alcohol consumption at four months post-partum were collected. Units of alcohol were assigned to the drinks consumed in line with national guidelines (HRB, 2012) and as detailed in **section 2.6.2**.

   Maternal wellbeing was assessed using three validated instruments. First, the **Mother and Baby Interaction Scale** (MABISC) (Hackney *et al.*, 1996; Høivik *et al.*, 2013) assessed distress and potentially suboptimal mother-infant bonding over the previous month. Participants used a five-point scale to indicate how often they felt as described by each item on the scale, *e.g.* 'My child can easily cheer me up'. Possible responses ranged from *always* (score of 0) to *never* (score of 4). Items 3, 7 and 9 were reverse-scored. Cut-off scores were ≤7 for *no distress,* 8-11 for *at risk of distress* and ≥12 for *a high probability of distress*.

   Second, an 8-item short version (version 8b) of the **BSQ** (Evans and Dolan, 1993) measured body shape concern. This questionnaire is outlined in detail in **section 2.6.2**.

Finally, the validated **14-item RS** (Wagnild and Young, 1993) measured resilience. This scale is outlined in detail in **section 2.6.2**.

Once a mother completed this questionnaire, the measurements taken on her infant were explained by the researcher and any questions she had were answered.

Mothers were then asked if they would be willing to be contacted by the researcher at nine months post-partum regarding the possibility of a home visit to assess their infant's growth again. If a mother responded positively, the end date of maternity leave was documented, in order to help the researcher to considerately contact her.

An A5 keepsake card with each infant's measurements (Appendix 12) and a thank you card were posted to mothers approximately one week after the home visit.

2.9 Contact at nine months post-partum

2.9.1 Arranging a home visit at nine months post-partum

Mothers were contacted by phone approximately one week before their infant turned nine months old. Visits were arranged using the protocol outlined in **section 2.8.1**.

2.9.2 Inclusion criteria for a home visit at nine months post-partum

Mothers whose healthy infants had been measured by the researcher at four months post-partum and who were willing to have a second home visit from the researcher were eligible for study inclusion at nine months post-partum.

2.9.3 Data obtained from mothers and infants at nine months post-partum

A consent form (Appendix 9) for the home visit was signed, and each infant had their clothes, vest and nappy removed to facilitate measurement (Appendix 13).

Physical measurements at nine months post-partum

The anthropometric measurements, crown-heel length measurement, and weight measurement were all taken using the same protocol outlined in **section 2.8.3**.

Questionnaire at nine months post-partum

While the researcher re-dressed the infant and plotted the infant's measurements using a gender-specific UK-WHO growth chart (RCPCH, 2013a; RCPCH, 2013b), mothers completed a quantitative questionnaire (Appendix 14), which obtained data on:

1. Milk feeding

   Any transitions between types of milk feeding from four to nine months post-partum were recorded, as were the current volumes of milk consumed.

2. Introduction of weaning foods

   Data collected on weaning included: age of the introduction of solids; first foods consumed; number of meals consumed; inclusion of snacks; use of condiments; and presence of diagnosed allergies. The texture of foods most commonly consumed were recorded to determine the use of a baby-led weaning (BLW) approach; mothers who used purées and spoon-feeding 10% of the time or less were assigned to the BLW category (Brown and Lee, 2011). The consumption of fluids other than breast milk, formula milk or water was also recorded.

3. Supplementation

   Supplementation practices for both mother and infant were recorded, to include the type of supplements consumed and the frequency of their consumption.

4. Health-related behaviours and wellbeing in the post-partum period

   Data on smoking status and alcohol consumption at nine months post-partum were collected. Units of alcohol were assigned to the drinks consumed in line with national guidelines (HRB, 2012) and as detailed in **section 2.6.2**.

Once this questionnaire was completed, the measurements taken were discussed. Finally, mothers were asked if they would be willing to be contacted by the researcher at 12 months post-partum regarding the possibility of a final home visit. Each mother's response was documented and mothers were thanked for their time.

An A5 keepsake card with each infant's measurements (Appendix 15), a copy of the cookbook *"101 Square Meals"* (Money Advice and Budgeting Services, 2008) and a thank you card were posted to mothers approximately one week after the home visit.

2.10 Contact at 12 months post-partum

2.10.1 Arranging a home visit at 12 months post-partum

Mothers were contacted by phone approximately one week before their infant turned 12 months old. Visits were arranged according to the protocol outlined in **section 2.8.1**.

Each infant was sent a handwritten birthday card thanking them for their participation in the study and wishing them a happy first birthday.

2.10.2 Inclusion criteria for a home visit at 12 months post-partum

Mothers whose healthy infants had been measured by the researcher at nine months post-partum and who were willing to have a home visit from the researcher were eligible for study inclusion at 12 months post-partum.

2.10.3 Data obtained from mothers and infants at 12 months post-partum

A consent form (Appendix 9) for the home visit was signed at the outset. Infants had their clothes, vest and nappy removed to facilitate measurement.

Physical measurements at 12 months post-partum

The anthropometric measurements, crown-heel length measurement and weight measurement were recorded (Appendix 16) using the protocol outlined in **section 2.8.3**.

Measurement of infant body composition at 12 months post-partum

Infant body composition was measured using the ImpediMed SFB7 (ImpediMed Ltd., Pinkenba, Queensland, Australia) device in bioimpedance spectroscopy (BIS) mode.

Each infant was re-dressed by their mother whilst the researcher set up the ImpediMed SFB7 (ImpediMed Ltd., Pinkenba, Queensland, Australia). All four colour-coded plug leads with alligator clips were inserted into the device. The device was switched on and the researcher set up a file for each infant by entering their study ID, gender, age, weight and length into the device. The device was set to record 55 measurements on each infant, with no interval or delay between measurements, *i.e.* all 55 measurements were taken immediately after one another. One measurement takes 0.7 seconds, but subjects must remain completely still for the measurement to be taken with accuracy. Since infants are unpredictable in this regard, a higher number of measurements were taken in an attempt to obtain some accurate measurements.

To prepare for the measurement, each infant's lower left arm and lower left leg were bared. An alcohol wipe was used to clean the skin on four areas: lower arm just above the wrist; dorsal surface of the hand; lower leg just above the instep; and instep.

Four electrodes were placed on the infant; one on each of the sites cleaned (see **Figure 2.1**). The pairs of electrodes on the arm and leg were spaced about five centimetres apart. The tab on each electrode faced outwards away from the body.

Figure 2.1 Placement sites for the electrodes placed on the left side of each infant's body in preparation for a bioimpedance analysis measurement

Although manufacturer instructions state that subjects should be in a supine position for the duration of the measurement, this proved impossible with most infants.

As such, all infants were placed in a slightly reclined position in the left-hand corner of a sofa, to allow the researcher access to the left side of their body. A rolled-up hand towel was tucked between each infant's thighs to ensure their legs remained separated (crossed legs would short-circuit the electrical path). A cushion was tucked against their right-hand side and their mother sat beside this cushion. Mothers were told to avoid touching their infant or giving their infant items to hold for the duration of the 55 measurements, as this would interfere with the accuracy of measurements taken.

Once each infant was in position, the researcher connected an alligator clip to the centre of each electrode, where the metallic part of the clip was in direct contact with the underside of the electrode tab. Each alligator clip was connected to a colour-coded lead, and each lead was connected to a specifically located electrode, with the:

- Yellow lead attached to the electrode on the lower arm just above the wrist;
- Red lead attached to the electrode on the dorsal surface of the hand;
- Blue lead attached to the electrode on the leg just above the instep; and,
- Black lead attached to the electrode on the instep.

The 'measure' button was pressed. The researcher and mother attempted to keep the infant as unmoving as possible for the duration of 55 measurements. However, this proved challenging in all cases and impossible in many. As such, although this device is theoretically suitable for use from the age of ten months onwards, the inability of infants to stay still, even for the duration of one measurement (0.7 seconds), renders many of the measurements invalid. This shortcoming of BIS will be discussed in **chapter six**.

Questionnaire at 12 months post-partum

While the researcher plotted the infant's measurements on a gender-specific UK-WHO growth chart (RCPCH, 2013a; RCPCH, 2013b), mothers completed a quantitative questionnaire (Appendix 17). The questionnaire was split into four sections, as follows.

1. Infant diet

   Data were obtained on the number of meals, snacks and fluids consumed daily by an infant. Data on diagnosed food allergies and hours of sleep (during the day and at night) were also documented.

2. Maternal feeding style and body image

   An adapted version (Brown and Lee, 2011) of the well-validated **Child Feeding Questionnaire** (CFQ) (Birch *et al.*, 2001) was used to assess maternal feeding style. The CFQ evaluates parental beliefs, attitudes and practices towards their child's diet (Birch *et al.*, 2001). The original CFQ (Birch *et al.*, 2001) was designed for use amongst parents of children aged between two and 11 years. However, the questionnaire was adapted in 2011 for use amongst parents with infants (Brown and Lee, 2011). This adaptation involved removing items which addressed parental use of food as a reward for good behaviour and which were inappropriate for child developmental age. However, items which targeted the six factors influencing control over a child's diet were retained and the response options were the same as those in the original questionnaire; thus the adapted CFQ retains the validity of the original CFQ.

   Control over a child's diet is comprised of six factors: perceived responsibility; concern for child weight; pressure to eat; restriction; monitoring; and perceived parental weight. Three factors were of particular interest to this study – pressure to eat, restriction and monitoring – since these factors represent a controlling feeding style. Each of these factors was measured on a five-point scale.

   For the *pressure to eat* subscale, mothers indicated their level of agreement with the four statements within the subscale, *e.g.* 'If my child is hungry, I try to get her to eat anyway'. Possible responses ranged from *disagree* (score of 0) to *agree* (score of 5).

For the *restriction* subscale, mothers indicated their level of agreement with the four statements within the subscale, *e.g.* 'I have to be sure that my child does not eat too many high fat foods'. Possible responses ranged from *disagree* (score of 0) to *agree* (score of 5).

For the *monitoring* subscale, mothers indicated how often they exhibited the behaviour described by the three statements within the subscale, *e.g.* 'How much do you keep track of the sweet foods your child eats?', with possible responses ranging from *never* (score of 0) to *always* (score of 5). An average score for each subscale was calculated by dividing the cumulative score for the subscale by the number of items within the subscale.

An 8-item short version (version 8b) of the **BSQ** (Evans and Dolan, 1993) was used to assess concern with body shape at 12 months post-partum. This questionnaire is outlined in detail in **section 2.6.2**.

3. Maternal and infant supplementation

Supplementation practices for both mother and infant were recorded, to include the type of supplements consumed and the frequency of their consumption.

4. Role of other carers and maternal smoking status and alcohol consumption

The time (hours per week) an infant spent with other carers (*e.g.* crèche) was documented. The source of the food (*i.e.* prepared by parents or by carers) consumed by an infant when they were in childcare was also recorded.

Data on maternal smoking status and on alcohol consumption at 12 months post-partum were also collected. Units of alcohol were assigned to the drinks consumed as detailed in **section 2.6.2**.

Record of food intake and conclusion of visit at 12 months post-partum

Three working days prior to the home visit, a 2-day prospective food diary for infants (Appendix 18) was posted to mothers with whom a home visit had been arranged. Mothers had been told to expect the food diary during the phone call to arrange their home visit with the researcher. Instructions on completing the diary and a set of five measuring spoons (¼ teaspoon, ½ teaspoon, one teaspoon, ½ tablespoon and one tablespoon) were provided to help mothers to estimate infant food intake.

During the home visit, mothers were asked to show the researcher the food diary they had completed on their infant's food and fluid intake over two days. The researcher checked the diary to ensure its satisfactory completion, and where relevant, asked the mother relevant clarifying questions about additions to food, cooking methods, food texture and food brands.

Finally, the measurements taken on each infant were discussed and mothers were thanked for their participation in the study. Each infant's final set of measurements (Appendix 19) were posted shortly after the visit, along with a thank you card and an "Active Play Every Day" pack for children aged 0-3 years (HSE, 2014).

2.11 Postal questionnaire to fathers

A cross-sectional semi-quantitative postal questionnaire (Appendix 20) was used to gain insight into the paternal experience of:

1. Pregnancy;
2. Milk feeding an infant (breastfeeding and/or formula feeding);
3. Breastfeeding in public; and
4. Coping in the early post-partum period.

2.11.1 Population targeted

The male partners of women who had given birth in the previous four to seven months in the CWIUH in Dublin were targeted. A list of women of Irish nationality who delivered a healthy live infant in the CWIUH during March, April, May, June, August and September 2014 was obtained. From this, men were targeted if they met all the following criteria: listed as next-of-kin, designated as a spouse or partner; and living at the same postal address as the patient. The application of such criteria resulted in 1,405 eligible men. In light of the low breastfeeding rate amongst Irish mothers at six months post-partum (Gallagher *et al*., 2015), questionnaires were sent to fathers with infants aged between four and seven months of age in order to obtain a more complete picture of breastfeeding in the early post-partum period.

2.11.2 Steps taken to maximise questionnaire response rate

Fathers were greeted by their first name in the letter (Appendix 21) which was included to explain the questionnaire. The letter briefly outlined the value of the questionnaire and provided a realistic estimate of the time needed (approximately ten minutes) to complete the questionnaire. Fathers could not be identified from the questionnaire or return envelope, and were assured that their responses were anonymous.

Each cover letter was signed by the researcher. A pen and a stamped addressed envelope were included to make questionnaire completion more convenient. Questionnaires were personally addressed to fathers and were delivered by standard post early in the working week (Mondays or Tuesdays). Fathers were given three months to return the questionnaire.

No incentives were used, and due to the anonymous return of questionnaires, no reminders to complete the questionnaire were issued. However, fathers were offered the opportunity to receive a lay report containing results from the questionnaire. Fathers were asked to text their name and address to the researcher, which would ensure that they obtained the questionnaire results while still allowing the questionnaire they completed to remain anonymous. A lay summary of the results was posted to these fathers.

2.11.3 Questions in the postal questionnaire

Eligible fathers (*n*1,405) were sent a paper-based semi-quantitative questionnaire (Appendix 20). Due to the lack of published data on the experience of becoming a father in Ireland, the questionnaire contained a mix of closed-ended and open-ended questions. The questionnaire covered four areas, as detailed below:

1. Pregnancy

   Closed questions in this section obtained data on useful sources of information on pregnancy, attendance at antenatal classes and on a father's perceived inclusion in their partner's pregnancy. Open-ended questions obtained data on information fathers would have liked to have had on pregnancy and on the aspects of pregnancy which fathers found most stressful.

2. Milk feeding an infant (breastfeeding and formula feeding)

   Fathers whose partner had breastfed their last (or only) child were asked closed-ended questions on: their role in the decision to breastfeed; sources of information on breastfeeding; their ability to assist with feeding challenges; and on preferred bonding activities with a breastfed infant. Open-ended questions obtained data on aspects of breastfeeding for which they felt unprepared and on the perceived advantages and disadvantages to having a breastfeeding partner.

   Fathers who had ever formula-fed their last (or only) child were asked closed-ended questions on their role in the decision to formula-feed and on useful sources of information on formula feeding. Open-ended questions obtained data on perceived advantages and disadvantages of formula feeding.

3. Breastfeeding in public

   A photo of a woman discreetly breastfeeding was shown. Fathers were asked what they would be likely to feel should they see a woman unrelated to them feeding in this way in everyday life. The list of potential reactions included: gladness, respect, surprise, indifference, embarrassment, discomfort and disgust.

Fathers were also asked how comfortable they would feel if their own partner ever chose to breastfeed in public. Fathers had to choose from one of three options: completely comfortable with no concerns; fairly comfortable but with a few concerns; or completely uncomfortable with a lot of concerns. If fathers felt concern over their partner breastfeeding in public, they were asked to state the nature of their concern.

4. Coping in the early post-partum period

   Fathers were asked to identify times when they would have liked more support in coping with the arrival of a new infant.

Sociodemographic data were also obtained, to include parity, age, nationality, marital status, educational attainment and employment status.

2.12 Development of questionnaires

2.12.1 Questionnaire design

Five questionnaires (Appendices 4, 11, 14, 17 and 20) were designed following a review of relevant literature. Each questionnaire aimed to obtain information which could address some of the knowledge gaps identified in each area of interest. All questionnaires were written in plain English (NALA, 2011) and consisted of predominantly closed-ended questions.

2.12.2 Questionnaire piloting amongst pregnant women and mothers

The four questionnaires completed by women (Appendices 4, 11, 14, and 17) in pregnancy and at four, nine and 12 months post-partum were piloted amongst 15 participants as each questionnaire was needed.

To pilot a questionnaire, the researcher:

- Timed each participant as they completed the questionnaire;
- Documented queries about the content of the questionnaire, *e.g.* queries which indicated confusion about the meaning of a question;
- Documented queries about questionnaire layout, *e.g.* queries about whether they were to skip particular questions which did not apply to them; and
- Recorded the overall impression of the questionnaire from participants, to include any comments on repetitious questions, redundant questions and length.

The information obtained from the piloting phases was used to make minor adjustments to each questionnaire to enhance their accessibility for future respondents.

2.12.3 Questionnaire piloting amongst fathers

The questionnaire completed by fathers (Appendix 20) whose partner had given birth four to seven months previously was a cross-sectional postal questionnaire which was anonymously returned.

This questionnaire was piloted with 20 male partners of women who were participating in the longitudinal study. Therefore, during the home visit at four months post-partum, partners who were present were asked if they would be willing to complete the questionnaire. The researcher documented the same information during the piloting of this questionnaire as that outlined in **section 2.12.2**. From the comments provided, minor adjustments were made to the layout of the questionnaire to enhance its appeal and accessibility for those who received it by post.

2.12.4 Quantitative and semi-quantitative approaches

Quantitative questionnaires offer the advantages of being economical and relatively quick to complete (Boynton and Greenhalgh, 2004). Such questionnaires are often an appropriate research tool when some information is already known on a particular subject area (Rattray and Jones, 2007). In light of the body of research available on maternal wellbeing and infant growth, it was possible to identify gaps in the literature on these subjects, particularly within the Irish context, and to devise closed-ended questions accordingly. In addition, validated instruments from other studies were included to ensure that robust data were obtained, *e.g.* Tilburg Pregnancy Distress Scale, Body Shape Questionnaire and Mother and Baby Interaction Scale.

A semi-quantitative approach was taken when developing the postal questionnaire for fathers. Only one other small Irish study has been conducted on the views of fathers on the early post-partum period, and as such, many of the questions included in this questionnaire were open-ended. Open-ended questions are neither strictly quantitative nor qualitative, and can lack conceptual richness as a result (O'Cathain and Thomas, 2004). However, in light of the lack of published research available on the views of fathers on the early post-partum period, a questionnaire comprised entirely of closed-ended questions would not have been appropriate. An exclusively qualitative study was not conducted with expectant fathers and new fathers, since a sex-matched researcher is often deemed most appropriate when interviewing individuals on subjects of a personal nature (Wolfberg *et al.*, 2004; Pisacane *et al.*, 2005). The analysis of these questions is described in detail in **chapter seven**.

2.13 Data handling and statistical analysis

2.13.1 Handling of socioeconomic data

Maternal and paternal occupations were first categorised according to the social class categories devised by the Central Statistics Office (1996). However, for the purposes of analysis, the social classes were collapsed into fewer groups (Tarrant, 2008):

- Professional, managerial and technical workers formed *social class I*;
- The non-manual group formed *social class II*;
- Skilled manual, semi-skilled and unskilled groups formed *social class III*;

- Unemployed persons, students and those whose occupation was unknown formed the *unknown class*; and
- Mothers who were stay-at-home mothers were placed in a separate category called *stay-at-home mother*.

2.13.2 Handling of nutrient data from food diaries

Data from the food diaries at 12 months post-partum were first entered into Nutritics Nutrition Analysis Software (Nutritics, Ireland) for nutrient analysis. Where foods (most commonly infant-specific foods) were not available in the Nutritics database, the researcher had the facility to manually add the nutritional information of these foods to the database. Total energy and nutrients of interest (*i.e.* protein, fat, carbohydrate, fibre, sodium, iron, calcium and vitamin D) were calculated by this software.

The resulting figures were entered into the International Business Machines Corporation (IBM) Statistical Package for the Social Sciences (SPSS) for Windows, version 22.0 (IBM, New York, United States).

2.13.3 Management of data and statistical analyses

Data were entered directly into SPSS for Windows, version 22.0, and all data analyses were conducted using SPSS. For quality assurance and to reduce the number of input errors, the author carried out double-entry for 20% of the questionnaires. Descriptive statistics and frequencies were also generated on the entire dataset to highlight any outliers or data which may have been inputted incorrectly (Pallant, 2010; Field, 2013).

Univariate analyses were conducted on all data (Pallant, 2010; Field, 2013). Normally distributed data were summarised numerically using the mean and standard deviation. Non-normally distributed data were summarised numerically using the median and interquartile range. The associations between categorical variables were assessed using cross-tabulations and the Chi-squared statistics test was used to assess statistical significance. Yates' Continuity Correction was used for 2x2 contingency tables to improve the Chi-square approximation. For continuous variables which were normally distributed, the comparison of two means was assessed using the Independent Samples *t*-test. Non-normally distributed means were compared using the Mann-Whitney *U* test. Statistical significance was taken at $p<0.05$.

The specific statistical methods used to analyse the study data (Pallant, 2010; Field, 2013) are described in greater detail in **chapters four**, **five**, **six** and **seven**.

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The work reported in this thesis was funded by Dublin Institute of Technology and Danone Nutricia Early Life Nutrition under the *Fiosraigh* Scholarship Programme.

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2.15 Conclusion

Two observational studies were conducted. The first was a longitudinal observational study amongst pregnant women and subsequently mothers and infants in counties Dublin, Meath, Kildare and Wicklow. The second was a cross-sectional observational study amongst men who had become fathers, for the first or subsequent time, over the previous four to seven months.

Quantitative and semi-quantitative data were obtained from these studies and the analyses of such data will provide insights into maternal and paternal influences on infant diet and growth throughout the first year of life.

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CHAPTER 3 Characteristics of the sample population

3.1 Introduction

This chapter will examine the characteristics of the samples investigated relative to the characteristics of the wider population. The samples which will be outlined are:

- Pregnant women recruited to the study (*n*270) from the Coombe Women and Infants University Hospital (CWIUH), whose data are further elucidated in **chapter four**;
- Mothers and infants who were followed-up at birth (*n*219), whose data are further elucidated in **chapters four**, **five** and **six**;
- Mothers and infants who were followed-up at four (*n*173), nine (*n*163) and 12 (*n*158) months post-partum, whose data are further elucidated in **chapters four**, **five** and **six**;
- Fathers (*n*417) who had a breastfeeding partner and who completed a cross-sectional questionnaire between four and seven months post-partum, whose data are further elucidated in **chapter seven**; and
- Non-responder population of pregnant women (*n*23) and the population lost to follow-up at birth (*n*51).

3.2 Timing of contact with participating women and infants

The mean gestational age of a participant's pregnancy at recruitment was 29.9 (standard deviation [SD] ± 6.9) weeks.

The mean age of infants upon being measured in hospital was 30.2 (SD ± 15.9) hours.

Mother-infant dyads were seen, on average, within three, six and eight days of infants turning four, nine and 12 months of age, respectively.

The cohort profile provides an overview of the number of women and infants in the study at each point of data collection, and is outlined in **Figure 3.1**.

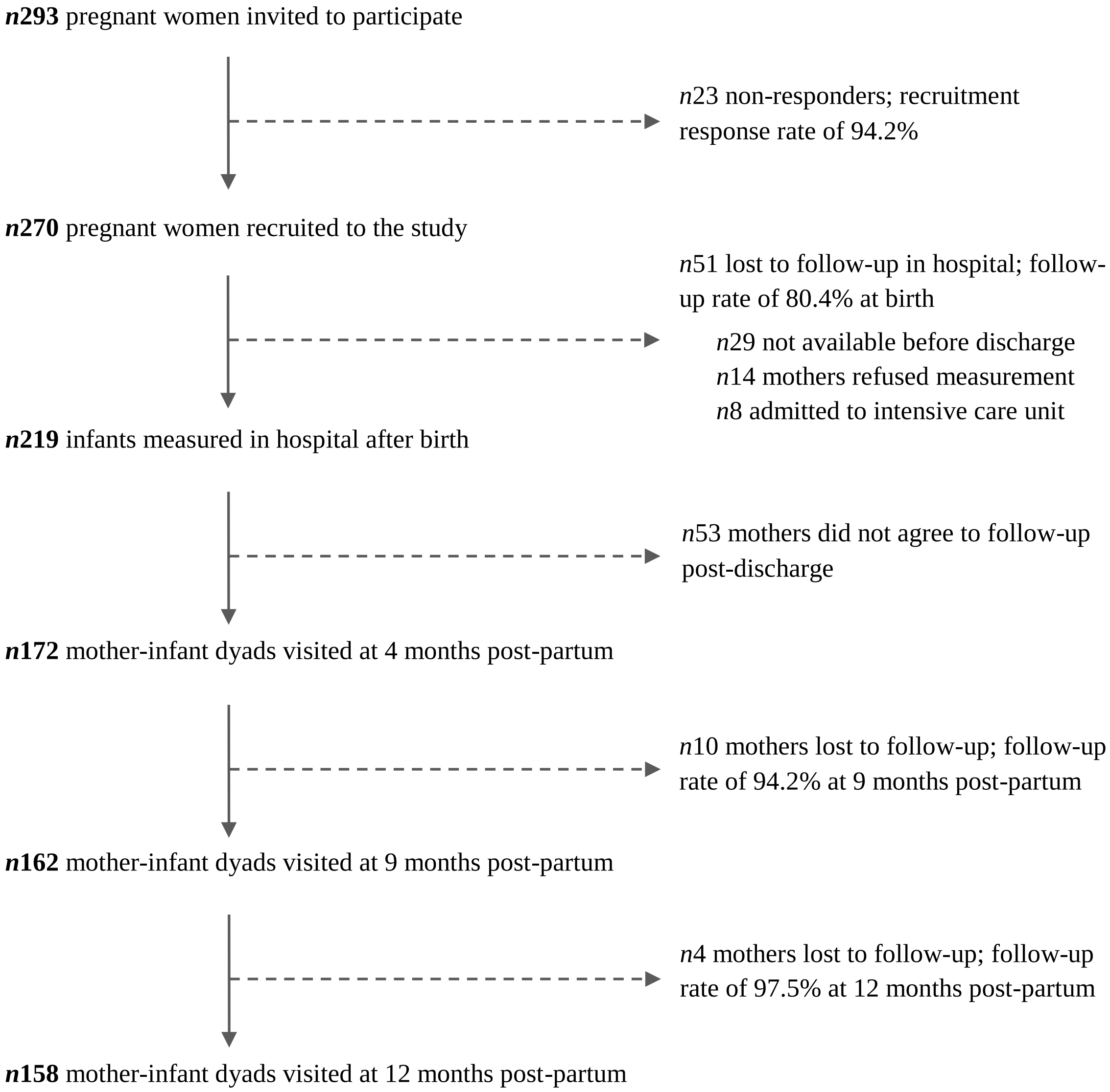

Figure 3.1 Profile of the study population, including those lost to follow-up, from recruitment to 12 months post-partum

3.3 Characteristics of pregnant women recruited

An overview of the sociodemographic characteristics of 270 pregnant women recruited to the study and their partners is provided in **Table 3.1**. The majority of the 270 participants were married (60.4%, *n*163), working full-time (56.7%, *n*153) and availing of public maternity services (70.0%, *n*189). Just over 60.0% (61.1%, *n*165) were third level-educated, which is slightly higher than the national average of 55.3% (Central Statistics Office [CSO], 2013). The proportion of unemployed participants (14.4%, *n*39) was higher than the national figure of 11.4% reported in 2013 (CSO, 2013), with over half (53.0%, *n*143) reporting some difficulty making ends meet in their household.

Table 3.1 Sociodemographic characteristics of pregnant women (*n*270) and their partners (*n*260)

		n	Mean ± SD
Maternal age in pregnancy	Years	270	31.4 ± 4.9
Maternal pre-pregnancy BMI	Kg/m^2	270	25.5 ± 4.5
		n	%
Nationality	Irish	265	98.1
	British	5	1.9
Maternal marital status	Married	163	60.4
	Cohabiting	69	25.6
	Not living with partner	28	10.4
	Single	10	3.7
Parity	Nulliparous	110	40.7
	Multiparous	160	59.3
Maternal health insurance	Public	189	70.0
	Semi-private	81	30.0
Medical card holder	Yes, medical card holder	50	18.5
	No medical card	220	81.5
Highest level of maternal education	Second-level education	69	25.6
	Vocational qualification	36	13.3
	Third level and/or postgraduate degree	165	61.1
Highest level of paternal education	Second-level education	87	33.5
	Vocational qualification	59	22.7
	Third level and/or postgraduate degree	114	43.8
Maternal employment status	Stay-at-home mother	34	12.6
	Working full-time	153	56.7
	Working part-time	44	16.3
	Unemployed	39	14.4
Paternal employment status	Working full-time	201	77.3
	Working part-time	19	7.3
	Unemployed or student	40	15.4
Maternal social class	Professional, managerial or technical	118	43.7
	Non-manual	55	20.4
	Skilled, semi-skilled and unskilled manual	27	10.0
	Unemployed	36	13.3
	Stay-at-home mother	34	12.6
Paternal social class	Professional, managerial or technical	101	37.4
	Non-manual	17	6.3
	Skilled, semi-skilled and unskilled manual	83	30.7
	Unemployed and unknown	69	25.6
Maternal material deprivation	Experiencing material deprivation	61	22.6
	Not experiencing material deprivation	209	77.4

SD: Standard deviation **BMI:** Body Mass Index **Kg/m^2:** kilograms per metre squared

Health behaviours amongst the study participants which are important to pregnancy outcomes are outlined in **Table 3.2**.

Table 3.2 Health behaviours of 270 women recruited in pregnancy

		n	%
Planned pregnancy	Yes, planned	197	73.0
	No, unplanned	73	27.0
Any folic acid supplementation	Yes	267	98.9
	No	3	1.1
Recommended folic acid supplementation*	Supplemented as recommended*	89	33.0
	Did not supplement as recommended*	181	67.0
Any other supplementation	Yes	162	60.0
	No	108	40.0
Types of 'other' supplements consumed	Pregnancy-specific multi-vitamin	116	71.6
	Iron	37	22.8
	General multi-vitamin	20	12.3
	Fish oils	12	7.4
	Vitamin D	5	3.1
Smoking status at conception	Current smoker	88	32.6
	Ex-smoker	39	14.4
	Never smoked	143	53.0
Smoking status when pregnancy was confirmed	Continued smoking on confirmation	28	10.4
	Abstained from smoking on confirmation	242	89.6
Antenatal alcohol consumption	Consumed alcohol antenatally	62	23.0
	Abstained from alcohol antenatally	208	77.0

* Recommended folic acid supplementation: consume a 400 microgram folic acid supplement every day from at least three months before conception to the twelfth week of pregnancy (*safe*food, 2015)

Almost three-quarters (73.0%, *n*197) of the study participants planned their pregnancy, which is higher than the rate of 68.8% reported amongst the CWIUH population (Coombe Women and Infants University Hospital [CWIUH], 2013). Despite this, only a third (33.0%, *n*89) correctly supplemented with folic acid for at least 12 weeks preconception; this practice of inadequate folic acid supplementation has been well-documented (McKeating *et al.*, 2015; Cawley *et al.*, 2016). The median duration of supplementation amongst those who took a folic acid supplement before conception (*n*146) was 12.0 (interquartile range [IQR] 6.0, 24.3) weeks. Amongst those who took a folic acid supplement, but not before conception (*n*121), the mean gestational age at which supplementation commenced was 6.0 (SD ± 3.2) weeks.

The rate of smoking at conception in this study (32.6%, *n*88) is higher than that in the nationally representative Growing Up in Ireland study (Williams *et al.*, 2010), which reported that 18.0% of women smoked at some point in their pregnancy. However, the proportion of women who smoked in all three trimesters in this study (10.4%, *n*28) is similar to both the 13.0% reported by the Growing Up in Ireland study (Williams *et al.*, 2010) and the 12.8% reported by the CWIUH Annual Report (2013).

The proportion of women who consumed alcohol antenatally is similar in this study (23.0%, *n*62) to the 20.0% reported by the Growing Up in Ireland study (Layte and McCrory, 2014). The number of units consumed per drinking occasion is also similar with that reported in the Growing Up in Ireland study (2.8 units), with pregnant women in this study consuming a mean of 2.5 units of alcohol per drinking occasion.

3.4 Maternal and infant characteristics at birth

Table 3.3 outlines the characteristics of participating mothers and infants at birth. Maternal age, gestational age at delivery, birth weight, body fat and percentage body fat were all comparable to national averages (Williams *et al.*, 2010; Hawkes *et al.*, 2011).

Birth length and head circumference were not obtained on all infants since 51 infants were lost to follow-up at birth, as outlined in **Figure 3.1**. Body composition was not obtained on 23 of the 219 infants measured, since the device used to measure body composition was unavailable or not functioning at the time of measurement.

The rate of caesarean section was lower in this study (23.0%, *n*62) compared to the overall CWIUH population, of which 28.0% of women undergo caesarean section (CWIUH, 2013). This was likely due to most women in this study having been recruited from community antenatal clinics, and only women with no high-risk pregnancy factors were eligible to attend such clinics.

Table 3.3 Birth-related characteristics of 270 mothers and infants

		n	Mean ± SD
Maternal age at delivery	Years	270	31.6 ± 4.9
Gestational age at delivery	Weeks	270	39.9 ± 1.4
Birth weight	Grams	270	3501.8 ± 491.6
Birth length	Centimetres	219†	51.2 ± 2.2
Birth head circumference	Centimetres	219†	35.1 ± 1.2
Infant fat mass at birth	Grams	196†	356.3 ± 155.2
Infant percentage body fat at birth	Percentage	196†	10.3 ± 3.7
		n	Median (IQR)
Length of hospital stay	Hours	270	47.5 (33.0, 71.2)
		n	%
Mode of delivery	Vaginal delivery	208	77.0
	Caesarean section	62	23.0
Infant gender	Male	139	51.5
	Female	131	48.5
First milk	Breast milk	151	55.9
	Formula milk	119	44.1
Feeding method on discharge	Exclusive breastfeeding	83	30.7
	Partial breastfeeding	38	14.1
	Formula feeding	149	55.2

SD: Standard deviation **IQR:** Interquartile range
† These measures were not obtained on all infants at birth

At 55.9%, the rate of breastfeeding initiation was higher in this study (**Table 3.3**) compared to the national average of 50.1%, but the breastfeeding rate of 44.8% on hospital discharge was similar to national figures of 42.5% (Layte and McCrory, 2014).

3.5 Maternal and infant characteristics in the post-partum period

An overview of maternal and infant characteristics at each point of data collection in the post-partum period is provided in **Table 3.4**. The median duration of any breastfeeding was 8.0 (IQR 1.8, 26.0) weeks. At 14.5%, the proportion of participating mothers who exclusively breastfed for 26 weeks was higher than the national average of 6.0% (Layte and McCrory, 2014).

Table 3.4 Characteristics of mothers and infants at 4, 9 and 12 months post-partum

	4 months post-partum (*n*172)		9 months post-partum (*n*162)		12 months post-partum (*n*158)	
	n	%	*n*	%	*n*	%
Maternal alcohol consumption						
Weekly consumption	43	25.0	55	34.0	47	29.7
Monthly consumption	47	27.3	39	24.1	42	26.6
Less often than monthly	54	31.4	48	29.6	47	29.7
No alcohol consumption	28	16.3	20	12.3	22	13.9
Maternal smoking status						
Smoking	20	11.6	22	13.6	24	15.2
Not smoking	152	88.4	140	86.4	134	84.8
Main milk drink						
Breast milk only	26	15.1	14	8.6	14	8.9
Formula milk only	131	76.2	138	85.2	101	63.9
Breast milk and formula milk	15	8.7	10	6.1	6	3.8
Recommended vitamin D supplementation*						
Yes, as recommended*	100	58.1	55	34.0	37	23.4
No, not as recommended*	72	41.9	108	66.0	121	76.6
Infant attending childcare						
Yes, in childcare	7	4.1	67	41.4	98	62.0
No, not in childcare	165	95.9	95	58.6	60	38.0

* Recommended vitamin D supplementation: infants should consume a 5 microgram vitamin D supplement every day from birth to 12 months post-partum (Food Safety Authority of Ireland, 2007)

At 12 months of age, toddler milk and cow milk were the main milk drinks consumed by 12.7% (*n*20) and 22.8% (*n*36) of infants, respectively.

All participants received advice on supplementing their infant with vitamin D before hospital discharge. Despite this, suboptimal supplementation practices were evident at all three points of data collection (**Table 3.4**) in the first year post-partum.

3.6 Characteristics of non-responders and those lost to follow-up

To assess the representativeness of the population sample investigated, comparisons must be drawn between responders and non-responders (Shepherd *et al.*, 1998).

Table 3.5 shows that the key characteristics of pregnant women who did (*n*270) and did not (*n*23) participate in the study were not significantly different.

Table 3.5 Comparisons between the characteristics of responders and non-responders

	Responders (*n*270)		Non-responders (*n*23)		*p*-value*
	n	Mean ± SD	*n*	Mean ± SD	
Maternal age at delivery (years)	270	31.6 ± 4.9	23	32.7 ± 3.8	0.33‡
Gestational age at delivery (weeks)	270	39.9 ± 1.4	23	40.3 ± 1.3	0.09‡
Birth weight (grams)	270	3501.8 ± 491.6	23	3548.6 ± 445.0	0.66‡
	n	Median (IQR)	*n*	Median (IQR)	
Hospital stay (hours)	270	47.5 (33.0, 71.2)	23	47.2 (30.2, 71.4)	0.82ϟ
	n	%	*n*	%	
Planned pregnancy					
Yes, planned	197	73.0	18	78.3	0.76†
No, unplanned	73	27.0	5	21.7	
Smoking status at conception					
Smoking	88	32.6	17	26.1	0.68†
Not smoking	182	67.4	6	73.9	
Maternal health insurance					
Public	189	70.0	19	82.6	0.30†
Semi-private	81	30.0	4	17.4	
Medical card holder					
Yes, has a medical card	50	18.5	18	21.7	0.92†
No medical card	220	81.5	5	78.3	
Any folic acid supplementation					
Yes, supplemented	267	98.9	22	95.7	0.73†
No, did not supplement	3	1.1	1	4.3	
Mode of delivery					
Vaginal delivery	208	77.0	19	82.6	0.72†
Caesarean section	62	23.0	4	17.3	
First milk					
Breast milk	151	55.9	8	34.8	0.08†
Formula milk	119	44.1	15	65.2	
Feeding method on discharge					
Exclusive breastfeeding	83	30.7	4	17.4	
Formula feeding	149	55.2	15	65.2	0.40ʃ
Partial breastfeeding	38	14.1	4	17.4	

* *p*-value of <0.05 was significant **SD:** Standard deviation **IQR:** Interquartile range

‡ Association between normally distributed continuous data assessed using an Independent Samples *t*-test

ϟ Association between non-normally distributed continuous data assessed using a Mann-Whitney *U* test

† Association between categorical variables assessed using the chi-squared test with Yates' Continuity Correction for 2x2 contingency tables

ʃ Association between categorical variables assessed using the chi-squared test for 3x2 contingency tables

Infants who were followed-up at birth were significantly different from those who were not in terms of gestational age at delivery and birth weight (**Table 3.6**). This is likely due to infants who were admitted to the intensive care unit and/or premature being lost to follow-up at this point in the study.

Table 3.6 Comparisons between the characteristics of responders and those lost to follow-up at birth

	Responders (n219)		Lost to follow-up (n51)		p-value*
	n	Mean ± SD	*n*	Mean ± SD	
Maternal age at delivery (years)	219	31.6 ± 5.0	51	31.7 ± 4.8	0.90‡
Gestational age at delivery (weeks)	219	39.9 ± 1.4	51	39.4 ± 12.7	**0.05‡**
Birth weight (grams)	219	3542.7 ± 472.0	51	3362.2 ± 538.9	**0.01‡**
	n	Median (IQR)	*n*	Median (IQR)	
Hospital stay (hours)	219	48.1 (33.4, 71.2)	51	45.2 (28.4, 74.0)	0.50ʯ
	n	%	*n*	%	
Planned pregnancy					
Yes, planned	161	73.5	36	70.6	0.80†
No, unplanned	58	26.5	15	29.4	
Smoking status at conception					
Smoking	73	33.3	15	29.4	0.71†
Not smoking	146	66.7	36	70.6	
Maternal health insurance					
Public	153	69.9	36	70.6	0.91†
Semi-private	66	30.1	15	29.4	
Medical card holder					
Yes, has a medical card	40	18.3	10	19.6	0.98†
No medical card	179	81.7	41	80.4	
Any folic acid supplementation					
Yes, supplemented	218	99.5	49	96.1	0.17†
No, did not supplement	1	0.5	2	3.9	
Mode of delivery					
Vaginal delivery	168	76.7	40	78.4	0.94†
Caesarean section	51	23.3	11	21.6	
First milk					
Breast milk	125	57.1	26	51.0	0.53†
Formula milk	94	42.9	25	49.0	
Feeding method on discharge					
Exclusive breastfeeding	70	32.0	13	25.5	
Formula feeding	119	54.3	30	58.8	0.40ʃ
Partial breastfeeding	30	13.7	8	15.7	

* *p*-value of <0.05 was significant **SD:** Standard deviation **IQR:** Interquartile range

‡ Association between normally distributed continuous data assessed using an Independent Samples *t*-test

ʯ Association between non-normally distributed continuous data assessed using a Mann-Whitney *U* test

† Association between categorical variables assessed using the chi-squared test with Yates' Continuity Correction for 2x2 contingency tables

ʃ Association between categorical variables assessed using the chi-squared test for 3x2 contingency tables

3.7 Characteristics of fathers with a breastfeeding partner

A cross-sectional questionnaire was posted to 1,405 fathers between four and seven months post-partum. Seven questionnaires were returned undelivered, resulting in 1,398 eligible questionnaires. Of these, 583 fathers (42% response rate) returned a completed questionnaire, and of these, 417 (71.5%) had a partner who initiated breastfeeding. **Chapter seven** of this thesis will focus solely on the views of fathers with a breastfeeding partner, and as such **Table 3.7** only summarises the key characteristics of fathers whose partner initiated breastfeeding. Due to the anonymous return of questionnaires, data on non-responders were not obtained.

Table 3.7 Sociodemographic characteristics of 417 fathers with a breastfeeding partner

		n	%
Parity	First-time father	156	37.4
	Not a first-time father	261	62.6
Age (years)	≤24	3	0.7
	25-29	17	4.1
	30-34	135	32.4
	35-39	171	41.0
	40-44	73	17.5
	≥45	18	4.3
Nationality	Irish	406	97.4
	British	7	1.7
	Other	4	0.9
Marital status	Married	366	87.8
	Cohabiting	50	12.0
	Not living with partner	1	0.2
Education	No formal education	1	0.2
	Primary and secondary school	57	13.7
	Vocational qualification	39	9.4
	College degree	139	33.3
	Postgraduate qualification	181	43.4
Employment status	Stay-at-home dad	3	0.7
	Working full-time	382	91.6
	Working part-time	17	4.1
	Unemployed	14	3.4
	Student	1	0.2
Formula-fed by time of questionnaire	Yes	361	86.6
	No	56	13.4

The mean age of fathers was 36.3 (SD ± 4.7) years and the majority (62.6%, *n*261) had at least one other child (mean 1.6 other children). Most fathers had completed a college degree (76.7%, *n*320) and were in full-time employment (91.6%, *n*382); figures for third level education and employment were higher in this study when compared with national averages (CSO, 2013). Additionally, the proportion of fathers in this study who had a partner who initiated breastfeeding (71.5%, *n*417) was higher than national figures (Williams *et al.*, 2010).

3.8 Conclusion

This chapter describes the key characteristics of those who participated in this study.

In summary, the sample of women recruited to this study had higher rates of third level education, planned pregnancies and breastfeeding initiation and duration compared to national figures. The lack of any significant differences between the characteristics of pregnant women who participated in the study with those who did not attenuates the potential for participation bias which may be implicated if these characteristics differed. Aside from significant differences in gestational age and birth weight, which were expected, the lack of differences between the key characteristics of women who were followed-up at birth with those who were lost to follow-up at birth also reduces the potential for participation bias had these characteristics differed.

The sample of men who completed a cross-sectional questionnaire had higher rates of education and employment compared to national averages, and a higher proportion had a partner who initiated breastfeeding compared to national figures. Although it is necessary to examine the needs of a group with such a socioeconomic background, it is also important to identify ways to involve fathers who are less well-educated and more socially disadvantaged in research.

Further details on each of the samples investigated are provided in the remaining chapters of this thesis.

3.9 References

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4.1 Introduction

4.1.1 Existing literature

The physical and emotional benefits of breastfeeding for mother and infant have been well-documented (Kramer and Kakuma, 2002; Gartner *et al.*, 2005; Li *et al.*, 2010; Sherriff and Hall, 2011). However, despite the plethora of benefits associated with breastfeeding, rates of breastfeeding initiation and duration in Ireland have consistently failed to meet the targets set for their improvement (Department of Health and Children, 2005; Brick and Nolan, 2014; Institute of Public Health in Ireland, 2014).

Breastfeeding is a complex physiological, psychological and socio-cultural act, and its outcomes are heavily influenced by the physical and mental wellbeing of a mother (Amir and Donath, 2007; Rasmussen, 2007; Li *et al.*, 2008). The often unrealistic promotion of this complex process as harmonious and unproblematic may result in inadequate practical and emotional preparation for its commencement (Fox *et al.*, 2015). Given that breastfeeding affects so many aspects of a woman's day-to-day life (*i.e.* her physical health, mental health and social and cultural activities), women must be prepared for the challenges breastfeeding poses to these aspects of life after pregnancy (McInnes and Chambers, 2008; Perez-Blasco *et al.*, 2013). Such preparation is needed to minimise discrepancies between a woman's expectations of breastfeeding and the reality of breastfeeding (Tammentie *et al.*, 2004; Salonen *et al.*, 2009).

When significant discrepancies between expectations and reality arise, disillusionment with breastfeeding can manifest, potentially resulting in maternal distress (O'Brien *et al.*, 2008). The distress resulting from a breastfeeding routine which belies a mother's expectations can be compounded by the tiredness and disrupted sleep associated with early motherhood, thus further exacerbating her vulnerability to emotional turmoil (Coates *et al.*, 2014; Yi *et al.*, 2016). Distress is a psychological problem which impairs daily functioning, and therefore it can negatively impact the breastfeeding relationship, mother-infant relationship, parental relationship and a woman's relationship with herself and her new mothering role (Coates *et al.*, 2014). With such potentially extensive consequences of distress, it is critical to understand how it may be attenuated, in order to better safeguard the healthy functioning of a breastfeeding mother, her infant and her wider family.

4.1.2 Knowledge gaps

Many studies have sought to gain an understanding of the factors which lead women to choose not to breastfeed or to cease breastfeeding shortly after its initiation (Bailey *et al.*, 2004; Li *et al.*, 2007; Li *et al.*, 2008; Tarrant *et al.*, 2009; Tarrant *et al.*, 2011; Whelan and Kearney, 2014; Gallagher *et al.*, 2015; Kronborg *et al.*, 2015; Smith *et al.*, 2015; Thomson *et al.*, 2015). Compared to other European countries, Irish women are a singular population when breastfeeding practices are investigated (Layte and McCrory, 2014; Gallagher *et al*., 2015). Irish women have the lowest breastfeeding initiation rate in Europe, rapid declines in rates of exclusive breastfeeding, and poor rates of breastfeeding duration beyond the first few weeks post-partum (Coombe Women and Infants University Hospital, 2013; Brick and Nolan, 2014; Layte and McCrory, 2014). So extensive is our formula feeding culture (Layte and McCrory, 2014), and of such duration (Curtin, 1954; Kevany *et al.*, 1975; McSweeney and Kevany, 1982; Fitzpatrick *et al.*, 1994; Tarrant *et al.*, 2009), that investment and policy initiatives over the past decade have been largely ineffective in increasing breastfeeding rates amongst Irish mothers (Brick and Nolan, 2014). Therefore, it's clear that there are fundamental elements of the Irish attitude towards breastfeeding which remain to be understood.

Many of the sociodemographic and practical aspects of breastfeeding have been examined in the Irish context. However, considerably less attention has been given to the impact of a woman's distress and emotional wellbeing on breastfeeding outcomes. Distress and emotional wellbeing are modifiable factors which heavily influence the breastfeeding process (Cooke *et al.*, 2007; Byrne *et al.*, 2014; Coates *et al.*, 2014). In the absence of any substantial research on these factors within the Irish context, this study sought to obtain measures of maternal distress and wellbeing and to examine the impact of these factors, if any, on breastfeeding outcomes.

4.2 Aims and objectives

This study aimed to investigate associations between breastfeeding and wellbeing in pregnancy and at four months post-partum. The objectives were to explore the:

- Prevalence of maternal distress in pregnancy and at four months post-partum;
- Prevalence of body shape concern in pregnancy and at four months post-partum;
- Maternal sociodemographic and health behavioural characteristics associated with distress in pregnancy and in the early post-partum period;
- Association between distress and breastfeeding outcomes; and
- Association between body shape concern in pregnancy and in the early post-partum period with breastfeeding outcomes.

4.3 Methodology

This chapter presents data on 270 pregnant women and 172 mother-infant dyads at four months post-partum. The study design, development of questionnaires, sample selection, and recruitment and follow-up of participants are described in **chapter two**, **sections 2.6 to 2.8**. The characteristics of both groups are described in **chapter three**.

4.3.1 Assessment of wellbeing in pregnancy

A quantitative questionnaire was completed in pregnancy by study participants (Appendix 4). All study participants completed the *Tilburg Pregnancy Distress Scale* (TPDS) (Pop *et al.*, 2011). This scale measures distress over the previous seven days, and the overall scale is comprised of two subscales – *negative affect* and *partner involvement* – which are explained in detail in **chapter two**, **section 2.6.2**.

A validated 8-item short version (version 8b) of the Body Shape Questionnaire (BSQ) (Evans and Dolan, 1993) was also completed by study participants in pregnancy. This instrument is explained in more detail in **chapter two**, **section 2.6.2**.

4.3.2 Assessment of wellbeing at four months post-partum

At four months post-partum, a home visit was conducted with study participants, during which mothers completed a questionnaire (Appendix 11). Three validated instruments which assessed maternal wellbeing were included in this questionnaire, as follows.

The *Mother and Baby Interaction Scale* (MABISC) (Hackney *et al.*, 1996; Høivik *et al.*, 2013) assessed distress and potentially suboptimal mother-infant bonding over the previous month. This scale is outlined in detail in **chapter two**, **section 2.8.3**.

A validated 8-item short version (version 8b) of the BSQ (Evans and Dolan, 1993) measured body shape concern at four months post-partum, and the specifics of this questionnaire are provided in **chapter two**, **section 2.6.2**.

The 14-item Resilience Scale (RS-14) (Wagnild and Young, 1993) measured resilience. This scale is outlined in more detail in **chapter two**, **section 2.6.2**.

4.3.3 Maternal and infant characteristics

Data on maternal body mass index (BMI) and sociodemographic characteristics were obtained in pregnancy. Data on maternal health behaviours were obtained in pregnancy and at four months post-partum. Infant milk feeding characteristics were recorded at birth and at four months post-partum using standardised definitions of milk feeding (World Health Organisation [WHO], 2004). The methods of recording these data are more fully described in **chapter two**, **sections 2.6.2 to 2.8.3**.

4.3.4 Statistical analyses

IBM SPSS for Windows, version 22.0 (IBM, New York, United States) was used to analyse data. The statistical significance level was taken at $p<0.05$.

Descriptive statistics

Normally distributed data and non-normally distributed data were summarised using the mean and standard deviation and the median and interquartile range (IQR), respectively.

Univariate and multivariate analyses

For continuous normally distributed variables, the comparison of means for two different groups was assessed using an Independent Samples *t*-test. A Paired Samples *t*-test compared two normally distributed means for the same group. Non-normally distributed means were compared using the Mann-Whitney *U* test. Associations between categorical variables were assessed using cross-tabulations and the Chi-squared statistics test assessed statistical significance. Yates' Continuity Correction was used for 2x2 contingency tables to improve the Chi-square approximation (Field, 2013).

Independent variables which were significant in univariate analyses were included in multivariate analyses. Maternal age and education level were also included in multivariate analyses, regardless of significance level, due to the precedence for their influence on the research topic (Drake *et al.*, 2007; Li *et al.*, 2008; Brown *et al.*, 2015).

Before multivariate analyses were conducted, Tabachnick and Fidell's (2007) formula was used to ensure that an acceptable number of independent variables were entered into each model. The sample size should meet or exceed 50 + 8m, where *m* is the number of independent variables necessary for inclusion in the model. The sample sizes available to predict distress in pregnancy and in the post-partum period were adequate for the number of variables entered into each model.

Multicollinearity was also assessed before multivariate analyses were conducted. To avoid multicollinearity, correlations were conducted between independent variables to ensure that the Pearson correlation coefficient was <0.9. If two variables were highly correlated (*i.e.* Pearson correlation coefficient was >0.9), the more appropriate of the two variables was included in the model whilst the other variable was excluded.

Binary logistic regression was then performed. The Forced Entry Method was used, whereby all predictor variables were tested in one block to assess their predictive ability while controlling for the effects of other predictors in the model (Pallant, 2010). To predict distress in pregnancy, the dependent variable was based on scores from the TPDS, where a score >17 indicated distress. Therefore, the codes for the dependent variable for this analysis were: *1 = distressed in pregnancy* and *0 = not distressed in pregnancy*. To predict distress in the post-partum period, scores from the MABISC were used. No distress was indicated by a score ≤7, at risk of distress was indicated by a score of 8-11 and a high probability of distress was indicated by a score ≥12. Due to the small number of mothers with a score ≥12, the codes for the dependent variable were: *1 = at risk of, or a high probability of, distress* and *0 = no distress*.

Once the analyses to predict distress had been performed, the usefulness of each model was assessed (Pallant, 2010). The Hosmer-Lemeshow Goodness of Fit Test was checked to ensure that $p>0.05$, to indicate support for a model. The Cox & Snell R Square and the Nagelkerke R Square values provided an indication of the amount of variation in the dependent variable which was explained by its model (Pallant, 2010).

The significance value produced by the Wald test for each independent variable in a model was then checked. Variables with a significance value of <0.05 contributed significantly to the predictive ability of a model, and therefore significantly predicted the dependent variable, *i.e.* distress in pregnancy or distress at four months post-partum.

The B values produced were also documented. Positive or negative ß values indicated the direction of the relationship between the dependent variable and each independent predictor in a model. The Exp (B) value, or odds ratio (OR), and the 95% confidence interval (CI) were also recorded for each independent variable. Finally, the ZResid values were assessed to ensure that no case with a ZResid value greater than 2.5 or less than -2.5 (*i.e.* cases which were clear outliers) had been included in the analyses.

4.4 Results

The sociodemographic and health behaviour characteristics of 270 women in pregnancy and 172 mothers followed-up at four months post-partum are described in greater detail in **Tables 3.1 to 3.4** in **chapter three**, **sections 3.3 to 3.5**.

4.4.1 Distress in pregnancy and at four months post-partum

The prevalence of distress amongst the pregnant sample in this study is shown in **Table 4.1**. While the mean score for the TPDS amongst the entire sample was 14.4 (standard deviation [SD] ± 7.2), indicating no significant distress, over a quarter (26.7%, *n*72) of participants were significantly distressed during their pregnancy. Almost a third (29.6%, *n*80) of participants were distressed on the *negative affect* subscale, and one in eight (12.2%, *n*33) were distressed on the *partner involvement* subscale.

Table 4.1 Prevalence of distress amongst 270 pregnant women according to the Tilburg Pregnancy Distress Scale

	Score category	*n*	%
Tilburg Pregnancy Distress Scale	Significant distress	72	26.7
	No significant distress	198	73.3
Negative Affect[¡] subscale on TPDS	Significant distress	80	29.6
	No significant distress	190	70.4
Partner Involvement[!] subscale on TPDS	Significant distress	33	12.2
	No significant distress	237	87.8

TPDS: Tilburg Pregnancy Distress Scale
[¡] *Negative affect* refers to perceptions of confinement and health in pregnancy and in the post-partum period
[!] *Partner involvement* refers to perceived partner involvement and support throughout pregnancy

Univariate analyses were conducted (**Table 4.2a**) to examine the maternal characteristics and infant feeding outcomes associated with distress in pregnancy. As shown in **Table 4.2a**, compared to women who experienced no significant distress in pregnancy, those who did were significantly more likely to: be a medical card holder; have an unplanned pregnancy; have no partner; be a first-time mother; be a smoker; or have body shape concern.

Table 4.2a Maternal characteristics associated with distress and no distress in pregnancy

	Significant maternal distress in pregnancy (*n*72)		No significant maternal distress in pregnancy (*n*198)		*p*-value*
	n	Mean ± SD	*n*	Mean ± SD	
Maternal age at delivery (years)	72	31.3 ± 5.5	198	31.8 ± 4.7	0.47‡
	n	Median (IQR)	*n*	Median (IQR)	
Duration of any breastfeeding (days)[!]	9	43.5 (2.0, 319.3)	89	56.0 (14.0, 182.0)	0.50∫
	n	%	*n*	%	
Maternal education					
Third level education	48	66.7	117	59.1	0.26†
No third level education	24	33.3	81	40.9	
Medical card holder	19	26.4	31	15.7	**0.05†**
Unplanned pregnancy	31	43.1	42	21.2	**<0.01†**
No partner involved in pregnancy	8	11.1	2	1.0	**<0.01†**
Parity					
Nulliparous	37	51.4	73	36.9	**0.05†**
Multiparous	35	48.6	125	63.1	
Smoking status at conception					
Smoking	27	37.5	61	30.8	0.30†
Not smoking	45	62.5	137	69.2	
Smoked in all three trimesters	13	18.1	15	7.6	**0.02†**
Consumed alcohol in pregnancy	21	29.2	41	20.7	0.19†
Supplementation with folic acid					
As recommended[¡]	18	25.0	71	35.9	0.13†
Not as recommended[¡]	54	75.0	127	64.1	
Maternal body mass index					
$\leq$24.9kg/m^2	35	48.6	102	51.5	0.78†
$\geq$25.0kg/m^2	37	51.4	96	48.5	
Maternal body shape concern					
No concern	50	69.4	180	90.9	**<0.01†**
Mild or moderate concern	22	30.6	18	9.1	
First milk					
Breast milk	39	54.2	112	56.6	0.83†
Formula milk	33	45.8	86	43.4	
Any breast milk on discharge					
Yes	26	36.1	95	48.0	0.11†
No	46	63.9	103	52.0	

* *p*-value of <0.05 was significant **SD:** Standard deviation **IQR:** Interquartile range

! The sample sizes for breastfeeding duration reflect the number of women who had provided data on distress in pregnancy and who were breastfeeding when followed-up at four months post-partum

¡ Recommended folic acid supplementation: consume a 400 microgram folic acid supplement every day from at least three months before conception to the twelfth week of pregnancy (*safe*food, 2015)

‡ Association between normally distributed continuous data assessed using an Independent Samples *t*-test

∫ Association between non-normally distributed continuous data assessed using a Mann-Whitney *U* test

† Association between categorical variables assessed using the chi-squared test with Yates' Continuity Correction for 2x2 contingency tables

Binary logistic regression was then conducted to determine which of the characteristics which were significant in univariate analyses (**Table 4.2a**) remained significant after controlling for other factors (**Table 4.2b**).

Table 4.2b Binary logistic regression model examining factors associated with significant distress amongst 270 pregnant women

	β	*n*	OR	95% CI	*p*-value*
Maternal third level education					
Yes	+	165	2.38	1.13 – 5.03	**0.02**
No		105	1.0	Ref.	
Medical card holder					
Yes	+	50	2.47	1.03 – 5.92	**0.04**
No		220	1.00	Ref.	
Parity					
Nulliparous	+	110	1.67	0.86 – 3.23	0.13
Multiparous		160	1.00	Ref.	
Planned pregnancy					
Yes	+	197	1.00	Ref.	**0.04**
No		73	2.18	1.05 – 4.52	
Partner involved in pregnancy					
Yes	+	260	1.00	Ref.	0.11
No		10	4.21	0.72 – 24.73	
Smoked in all 3 trimesters					
Yes	-	28	0.43	0.17 – 1.13	0.09
No		242	1.00	Ref.	
Body shape concern in pregnancy					
Yes	+	40	4.88	2.24 – 10.65	**<0.01**
No		230	1.0	Ref.	
Maternal age	+	270	1.07	0.99 – 1.15	0.07

Model summary:
R^2 = 0.29, Cox & Snell R Square = 15.9, Nagelkerke R Square = 23.1, 77.8% predictive of variance

* *p*-value <0.05 was significant **OR:** Odds ratio **CI:** Confidence interval

As shown in the statistically significant adjusted model (χ^2 (8, *n*270) = 46.69, $p<0.01$) in **Table 4.2b**, four of the eight independent variables included made a statistically significant contribution to the model.

The strongest predictor of significant distress in pregnancy was having body shape concern in pregnancy. Mothers with body shape concern were almost five times (β = 1.586, OR: 4.88 [95% CI: 2.24-10.65]) more likely to experience distress compared with mothers who did not have any body shape concern (**Table 4.2b**). Furthermore, when compared with women who had a planned pregnancy, no medical card or no college education, women who had an unplanned pregnancy, a medical card or a college education, respectively, were significantly more likely to experience distress in pregnancy (**Table 4.2b**)

Maternal distress at four months post-partum was also measured. The mean score on the MABISC was 6.5 (SD ± 3.7), which indicates no significant maternal distress. Maternal distress at four months post-partum was split into three categories, which are shown in **Table 4.3**.

Table 4.3 Prevalence of maternal distress amongst a sample of 172 mothers at 4 months post-partum

Instrument	Score category	*n*	%
Mother and Baby Interaction Scale	High probability of distress	14	8.1
	At risk of distress	48	27.9
	No distress	110	64.0

The majority (64.0%, *n*110) of mothers were coping well with the adjustment to motherhood. However, over a quarter (27.9%, *n*48) were at some risk of distress and one in twelve (8.1%, *n*14) was at a significant risk of distress (**Table 4.3**).

The characteristics of mothers who had no significant distress (64.0%, *n*110) were first compared with those of mothers who were experiencing some degree of distress (36.0%, *n*62). From these univariate analyses, distress was more likely if a mother was older, dissatisfied with partner involvement in pregnancy, multiparous or breastfeeding (**Table 4.4a**). Distress was also more likely amongst mothers with low resilience scores (**Table 4.4a**).

Multivariate analyses were then conducted to examine the factors associated with distress and potentially suboptimal mother-infant interaction at four months post-partum. As shown in the statistically significant adjusted model (χ^2 (6, *n*172) = 43.15, p<0.01) in **Table 4.4b**, four of the six independent variables included made a statistically significant contribution to the model.

Table 4.4a Comparison of maternal characteristics associated with distress and potentially suboptimal mother-infant interaction at 4 months post-partum

	Significant distress at 4 months post-partum (*n*62)		No significant distress at 4 months post-partum (*n*110)		*p*-value*
	n	Mean ± SD	*n*	Mean ± SD	
Maternal age at delivery (years)	62	33.8 ± 4.2	110	31.0 ± 4.9	**<0.01‡**
	n	Median (IQR)	*n*	Median (IQR)	
Duration of any breastfeeding (days)	35	168.0 (42.0, 365.0)	62	38.5 (4.0, 91.0)	**<0.01∫**
	n	%	*n*	%	
Maternal education					
Third level education	45	72.6	66	60.0	0.14†
No third level education	17	27.4	44	40.0	
Unplanned pregnancy	18	29.0	27	24.5	0.64†
No partner involved in pregnancy	3	4.8	2	1.8	0.26†
Parity					
Nulliparous	20	32.3	55	50.0	**0.02†**
Multiparous	42	67.7	55	50.0	
Smoked in all three trimesters	4	6.5	9	8.2	0.91†
Consumed alcohol in pregnancy	15	24.2	23	20.9	0.76†
Maternal body mass index					
≤24.9kg/m^2	32	51.6	51	46.4	0.62†
≥25.0kg/m^2	30	48.4	59	53.6	
Significantly distressed on TPDS					
Overall scale	20	37.7	23	41.8	0.14†
Negative affect subscale	22	41.5	26	47.3	0.13†
Partner involvement subscale	11	20.7	6	10.9	**0.02†**
First milk					
Breast milk	43	69.4	69	62.7	0.48†
Formula milk	19	30.6	41	37.3	
Breastfeeding at 4 months post-partum	24	38.7	17	15.5	**<0.01†**
Breastfeeding at 9 months post-partum	15	25.9	9	8.7	**<0.01†**
Breastfeeding at 12 months post-partum	14	24.1	6	6.1	**<0.01†**
Had supports in place to breastfeed	16	41.0	31	46.3	0.75†
Post-partum body shape concern					
No concern	32	51.6	49	44.5	0.46†
Mild, moderate or marked concern	30	48.4	61	55.5	
Post-partum resilience category					
High resilience	46	74.2	103	93.6	**<0.01†**
Low resilience	16	25.8	7	6.4	
Weaned at an appropriate age	52	89.7	87	83.7	0.42†

SD: Standard deviation **IQR:** Interquartile range **TPDS:** Tilburg Pregnancy Distress Scale

* *p*-value of <0.05 was significant

! The sample sizes for breastfeeding duration reflect the number of women who had provided data on distress in pregnancy and who were breastfeeding when followed-up at four months post-partum

‡ Association between normally distributed continuous data assessed using an Independent Samples *t*-test

∫ Association between non-normally distributed continuous data assessed using a Mann-Whitney *U* test

† Association between categorical variables assessed using the chi-squared test with Yates' Continuity Correction for 2x2 contingency tables

Table 4.4b Binary logistic regression model examining factors associated with distress and potentially suboptimal mother-infant interaction at 4 months post-partum

	β	*n*	OR	95% CI	*p*-value*
Maternal third level education					
Yes	+	111	1.40	0.63 – 3.12	0.41
No		61	1.00	Ref.	
Parity					
Nulliparous	+	75	1.00	Ref.	0.24
Multiparous		97	1.60	0.74 – 3.47	
Breastfeeding at 4 months post-partum					
Yes	+	41	2.89	1.29 – 6.47	**0.01**
No		131	1.00	Ref.	
Distressed by partner involvement antenatally†					
Yes	+	17	3.89	1.20 – 12.65	**0.02**
No		155	1.00	Ref.	
Resilience level at 4 months post-partum†					
High	+	149	1.00	Ref.	**<0.01**
Low		23	7.22	2.49 – 20.95	
Maternal age	+	172	1.11	1.02 – 1.21	**0.02**

Model summary:
R^2 = 0.16, Cox & Snell R Square = 22.2, Nagelkerke R Square = 30.4, 72.7% predictive of variance

* *p*-value <0.05 was significant **OR:** Odds ratio **CI:** Confidence interval
† Distress measured by the Tilburg Pregnancy Distress Scale

The strongest predictor of distress and at four months post-partum was low resilience. Mothers with low resilience scores were over seven times (β = 1.976, OR: 7.22 [95% CI: 2.49-20.95]) more likely to be at risk of distress and therefore were at a greater risk of suboptimal interaction with their infant when compared with mothers who reported high resilience scores (**Table 4.4b**). Furthermore, when compared to mothers who were younger, not breastfeeding or who had a positive perception of partner involvement in their pregnancy (**Table 4.4b**), mothers were significantly more likely to feel distressed at four months post-partum if they were older, breastfeeding at this time or had been distressed by their perception of their partner's involvement in pregnancy, respectively.

4.4.2 Body shape concern in pregnancy and at four months post-partum

Body shape concern in pregnancy and at four months post-partum was also examined. The average pre-pregnancy BMI in this sample was 25.4kg/m^2. The majority (85.2%, *n*230) of participants had no body shape concern in pregnancy (**Table 4.5**). Of the minority who had some degree of concern, this concern was mild or moderate, with no participant having marked body shape concern in pregnancy.

Table 4.5 Prevalence of maternal body shape concern amongst 270 pregnant women and amongst 172 mothers at 4 months post-partum

	Score category	*n*	%
Pregnancy	Moderate body shape concern	7	2.6
	Mild body shape concern	33	12.2
	No body shape concern	230	85.2
Four months post-partum	Marked body shape concern	12	7.0
	Moderate body shape concern	24	14.0
	Mild body shape concern	45	26.2
	No body shape concern	91	52.9

However, mean scores for body shape concern significantly increased between pregnancy and four months post-partum (12.7 *versus* 19.4, respectively, $p<0.01$). At four months post-partum, half (52.9%, *n*91) of mothers had no body shape concern, over a quarter (26.2%, *n*45) had mild body shape concern, and over a fifth (21.0%, *n*36) had moderate or marked body shape concern (**Table 4.5**).

In terms of the association between body shape concern and resulting milk feeding practices, body shape concern in pregnancy was not significantly associated with breastfeeding initiation ($p=0.25$) or duration ($p=0.51$).

However, at four months post-partum, body shape concern was associated with milk feeding practices. For analysis, body shape concern scores were divided into *no concern* (52.9%, *n*91) and *some degree of concern* (47.1%, *n*81), where *some degree of concern* encompassed all women whose scores on the BSQ fell into the mild, moderate or marked categories of body shape concern.

Univariate analyses indicated that body shape concern was not significantly associated with maternal age, third level education, parity, marital status or smoking and alcohol status. However, body shape concern was significantly associated with pre-pregnancy BMI. When compared to mothers with no body shape concern, mothers with some degree of concern were significantly (p=0.01) more likely to have an overweight BMI of ≥25.0kg/m^2. Furthermore, mothers with an overweight pre-pregnancy BMI of ≥25.0kg/m^2 breastfed for a significantly (p=0.03) shorter duration when compared to mothers with a BMI of ≤25.0kg/m^2.

Having body shape concern at four months post-partum was associated with breastfeeding at this time. When compared to mothers with body shape concern, mothers who had no body shape concern at four months post-partum were significantly more likely to be breastfeeding at this time (**Table 4.6**).

Table 4.6 Comparisons between the milk feeding decisions of mothers who have no body shape concern with those who have body shape concern at 4 months post-partum

	Mild, moderate or marked body shape concern (*n*81)		No body shape concern (*n*91)		*p*-value*
	n	%	*n*	%	
First milk after birth					
Breast milk	56	69.1	56	61.5	0.38†
Formula milk	25	30.9	35	38.5	
Feeding at 4 months post-partum					
Any breastfeeding	11	13.6	30	33.0	**<0.01†**
Formula feeding	70	86.4	61	67.0	

* *p*-value of <0.05 was significant

† Association between categorical variables assessed using the chi-squared test with Yates' Continuity Correction for 2x2 contingency tables

In terms of overall breastfeeding duration, mothers who had some degree of body shape concern at four months post-partum breastfed for a median of 42.0 days (IQR 2.0, 91.0), whereas mothers with no body shape concern at four months post-partum breastfed for a median of 121.0 days (IQR 22.8, 365.0).

4.4.3 Maternal preparation for breastfeeding challenges

Of the 172 mothers who were followed-up at four months post-partum, almost two-thirds initiated breastfeeding (65.1%, *n*112). This rate decreased to 52.9% (*n*91) doing any breastfeeding at hospital discharge, and to 23.8% (*n*41) doing any breastfeeding at four months post-partum. Of the 21 mothers who initiated and ceased breastfeeding before hospital discharge, 90.5% (*n*19) were unprepared for the challenges they encountered when attempting to establish breastfeeding.

Of those mothers who breastfed beyond hospital discharge (52.9%, *n*91), 37.6% (*n*38) were unprepared for the challenges they encountered whilst breastfeeding. Almost half (48.2%, *n*41) were prepared for the challenges encountered and one in seven (14.1%, *n*12) reported having no challenges with breastfeeding.

At four months post-partum, only two in five (42.9%, *n*47) mothers who initiated breastfeeding reported putting supports (*e.g.* visiting breastfeeding groups during pregnancy or asking family members to assist with household tasks after the birth) in place to increase the likelihood of a successful breastfeeding outcome.

4.5 Discussion

Carrying, and giving birth to, a child marks an important transition from one stage of a woman's life to another. While joy is so often associated with this time of a woman's life, it is also a time of increased vulnerability and psychological distress (Edhborg *et al.*, 2005; Munk-Olsen *et al.*, 2006; Haga *et al.*, 2012). This study indicates that a significant minority of women experience distress and body shape concern throughout pregnancy and the post-partum period, and that this emotional tumult is associated with milk feeding outcomes. In light of the persistently suboptimal breastfeeding rates in Ireland (Gallagher *et al.*, 2015), the wellbeing of, and support offered to, women during pregnancy and the early post-partum period merits close attention.

4.5.1 Potential consequences of maternal distress

In this study, over a quarter of women experienced significant distress during pregnancy and over a third experienced distress at four months post-partum. Distress during pregnancy not only negatively impacts a woman's physical health and quality of life (Davis and Sandman, 2010; Pop *et al.*, 2011; Perez-Blasco *et al.*, 2013), but can also increase the risk of obstetric complications, such as poor foetal growth, preterm birth and increased technical intervention at delivery (Dole *et al.*, 2003; Diego *et al.*, 2006; Zhu *et al.*, 2010). Mothers experiencing distress in pregnancy are also more likely to suffer from post-partum depression (Pop *et al.*, 2011; Høivik *et al.*, 2013) and the infants of distressed mothers are more likely to demonstrate adverse outcomes, such as delayed motor and mental development (Huizink *et al.*, 2003; Bergman *et al.*, 2007; Beijers *et al.*, 2010; Davis and Sandman, 2010). Therefore, distress clearly has an impact on certain maternal and infant outcomes, and of particular interest to this study was the potential impact of distress on breastfeeding outcomes.

4.5.2 Distress in pregnancy and breastfeeding outcomes

The results of studies investigating the relationship between breastfeeding cessation and maternal distress in pregnancy have been mixed, with some reporting a positive association (Papinczak and Turner, 2000; Kronborg and Væth, 2004; Li *et al.*, 2007) and others reporting no association (Cooke *et al.*, 2007). In this study, distress in pregnancy was not significantly associated with breastfeeding initiation or breastfeeding on hospital discharge. However, on hospital discharge, over a third of mothers who were distressed in pregnancy were breastfeeding, whereas almost half of mothers who were not distressed in pregnancy were breastfeeding. Although not statistically significant, this difference may be clinically significant and warrants some discussion.

Maternal self-efficacy is defined as a mother’s self-reported competency at fulfilling her maternal role (Coleman and Hildebrant Karraker, 2000). Self-efficacy is inversely related to distress; as distress increases, a woman’s sense of self-efficacy diminishes (Jones and Prinz, 2005; Sevigny and Loutzenhiser, 2009). Therefore, women experiencing distress in pregnancy may lack confidence in their perceived ability to adapt to the demands of motherhood (Cooke *et al*., 2007).

Breastfeeding is often regarded as a challenging demand of motherhood (Thomson *et al.*, 2015), particularly in Ireland, which has a long-reigning formula feeding culture (Brick and Nolan, 2014; Gallagher *et al.*, 2015) and widely reported inadequate breastfeeding support (Leahy-Warren *et al.*, 2014; Bennett *et al.*, 2016). *Confident commitment* is an important variable for breastfeeding success. This variable has three components: confidence in the process of breastfeeding; confidence in breastfeeding ability; and commitment to making breastfeeding work despite obstacles (Avery *et al.*, 2009). The process of developing a *confident commitment* to breastfeeding appears to occur in pregnancy (Blyth *et al.*, 2002), and without it, breastfeeding appears to cease once challenged (Avery *et al.*, 2009).

The sharpest decline in rates of breastfeeding occurs within the first week post-partum (Layte and McCrory, 2014), highlighting the importance of preparing pregnant women for the feeding challenges they are likely to encounter in this time (Trickey and Newburn, 2014; Fox *et al.*, 2015). In this study, the overwhelming majority of women who did not breastfeed beyond hospital discharge did not anticipate their breastfeeding challenges. Therefore, pregnancy is a crucial time to enhance a woman's sense of self-efficacy in the face of breastfeeding (Kronborg and Væth, 2004; Gilmour *et al.*, 2009). Although not statistically significant, the difference in breastfeeding rates on hospital discharge between mothers who were and were not distressed in pregnancy would tentatively suggest that distress may increase the likelihood of early breastfeeding cessation and that further investigation of this relationship is justified.

It is also important to note that, breastfeeding aside, over a quarter of pregnant women in this study experienced significant distress. Given the potential negative impact of distress on other aspects of maternal and infant health, the routine use of an economical psychometric instrument such as the TPDS could result in earlier identification of women in need of additional support (Pop *et al.*, 2011). By identifying such women and offering support appropriate to their needs, a valuable investment could be made in aspects of maternal and infant health far beyond feeding choice.

4.5.3 Distress at four months post-partum and breastfeeding outcomes

Women in Ireland who are breastfeeding at four months post-partum are in the minority, with only one in five Irish women breastfeeding, exclusively or otherwise, at this time (Layte and McCrory, 2014). Just as it is important to understand the feeding challenges experienced in the early post-partum period, it is also important to understand the challenges experienced by women who persevere with breastfeeding beyond the first few weeks post-partum. In this study, women who were breastfeeding at four months post-partum were almost three times more likely to be distressed.

Breastfeeding is a complex process underpinned by a woman's motivation to breastfeed, beliefs and social support (Cooke *et al*., 2007). The ubiquitous phrase in breastfeeding promotion – *breast is best* – was developed to summarise available scientific knowledge on the myriad benefits of breast milk (American Academy of Pediatrics, 2012). While it is right that the many physical and emotional benefits of breastfeeding are promoted (Department of Health, 1994; WHO, 2004; Department of Health and Children, 2005; Gartner *et al.,* 2005), this phrasing encourages many to equate breastfeeding with being a good mother (Schmied *et al.*, 2001; Cooke *et al*., 2007; Fox *et al*., 2015). As such, the phrase has implicit moralistic connotations (Thomson *et al*., 2015) which often result in women evaluating their maternal abilities based on milk feeding outcomes (Cooke *et al.*, 2007).

A review by Meedya *et al.* (2010) concluded that there are three factors which lend themselves to a breastfeeding experience in which distress is less likely to feature. They are: a positive antenatal intention to breastfeed, high maternal resilience and strong social support.

As already discussed, pregnancy is an important time to influence the intention to breastfeed, ideally by helping women to develop a sense of *confident commitment* to breastfeeding (Avery *et al*., 2009). With respect to resilience, a resilient individual tends to cope with challenging situations with equanimity and to feel confident that they have the capacity to resolve difficulties (Wagnild and Young, 1990; Wagnild and Young, 1993; Coleman and Hildebrant Karraker, 2003). This sense of competence and self-confidence acts as a buffer against distress, and can therefore increase the likelihood of a mother coping well with breastfeeding challenges (Altmaier and Maloney, 2007; Bloomfield and Kendall, 2012; Byrne *et al.*, 2014). While a woman's resilience helps her to cope with the challenges of motherhood, her sources of support outside of herself are also important, *i.e.* her social network. A woman's partner is instrumental in helping her to cope with the intricacies of motherhood, breastfeeding included (Goodman, 2005; Pisacane *et al*., 2005; Susin and Giugliani, 2008).

Distress was significantly associated with breastfeeding at four months post-partum in this study. Although it may seem counterintuitive for a mother to persist with an activity which causes her distress, it is possible that the commitment to, and value placed upon, breastfeeding by certain mothers is such that any distress related to being the sole food provider for an infant is made tolerable or at least reduced. Such commitment may also enable a mother to continue to breastfeed despite shortcomings in her resilience or support network (Schmied *et al*., 2001; Cooke *et al*., 2007).

Perseverance with breastfeeding despite its associated physical and emotional challenges has been well-documented (McInnes and Chambers, 2008; O'Brien *et al*., 2008; Thomson *et al*., 2015). Although this dedication to the wellbeing of the infant is admirable, it is imperative that the wellbeing of the mother is also protected. Maternal resilience and social support are modifiable factors important to the harmony of the breastfeeding relationship between mother and infant (Kronborg and Væth, 2004; Fox *et al*., 2015). In this study, mothers with low resilience were over seven times more likely to be distressed and mothers with an antenatal perception of suboptimal partner support were almost four times more likely to be distressed at four months post-partum.

These aspects of wellbeing may be important targets for health providers aiming to develop strategies which improve the breastfeeding experience for mothers in Ireland.

Previous research has demonstrated the effectiveness of using mindfulness and cognitive behavioural therapy techniques to target maternal resilience. For example, compared to controls, a mindfulness-based cognitive therapy (MBCT) intervention for pregnant women demonstrated clinically reliable reductions in stress, depression and anxiety amongst participants over the 8-week intervention (Dunn *et al.*, 2012). The intervention included teaching pregnant women how to foster acceptance, manage negative thoughts and deal with obstacles, and the resulting improvements in wellbeing continued into the postnatal period (Dunn *et al.*, 2012). Similarly, another 8-week MBCT intervention, which was provided in weekly sessions, each of two hours duration, resulted in statistically and clinically significant reductions in stress, depression and anxiety, while significantly increasing self-compassion and mindfulness (Goodman *et al.*, 2014).

Some interventions which recorded improvements in maternal wellbeing also examined how women perceive, and react to, their partner and other family members. Positive changes in a woman's personal practice often led to positive changes in her interactions with family members (Bloomfield and Kendall, 2012; Perez-Blasco *et al.*, 2013), thus reducing overall parenting and family stress (Duncan *et al.*, 2009).

An intervention study which combined mindfulness with skills-based parental education significantly improved maternal resilience whilst equipping women with essential parenting skills (Byrne *et al.*, 2014). A similar approach could be considered for pregnant women intending to breastfeed. Such an intervention could: reinforce the positive antenatal intention to breastfeed; enhance resilience; improve self-efficacy through the demonstration of breastfeeding techniques; and teach communication strategies which help to strengthen support networks. No study to date has attempted to modify all these factors simultaneously. If it is not feasible for a provider to deliver such an intervention directly to participants, the provision of breastfeeding interventions via the Internet has shown promise (Pate, 2009; Lau *et al.*, 2016) and could be considered.

The universal challenges associated with breastfeeding are compounded by the longstanding formula feeding culture in Ireland (Layte and McCrory, 2014). Therefore, a comprehensive breastfeeding intervention may provide valuable data on practical measures which can be taken to enhance the breastfeeding experience, and in so doing, enhance the care and wellbeing of mother, infant, father and wider family.

4.5.4 Body shape concern and breastfeeding outcomes

Body shape concern occurs when a discrepancy develops between one's perceived current figure and one's ideal figure (Heinberg, 1996). During pregnancy and the transition to motherhood, women deal with continual changes to their size and shape, and such changes may affect the way in which they view their body (Rallis *et al.*, 2007).

Body shape concern in pregnancy was not an issue for the vast majority of participants in this study. Pregnant women undergo a considerable departure from the slender body which is considered the "ideal" in western societies (Gow *et al.*, 2012; Roth *et al.*, 2012; Meireles *et al.*, 2015). However, these changes are often viewed as a natural and expected part of childbearing, especially in late pregnancy (Rallis *et al.*, 2007), and therefore they often do not translate into increased body shape concern (Boscaglia *et al.*, 2003; Rallis *et al.*, 2007).

However, body shape concern increased significantly between pregnancy and the post-partum period in this study, a finding which corresponds with previous research (Duncombe *et al.*, 2008; Clark *et al.*, 2009). Body shape concern often increases as the post-partum period progresses and generally peaks at about six months post-partum, when women can no longer say that they have recently given birth (Rallis *et al.*, 2007; Shloim, 2014).

Increasing body shape concern and the negative thought processes which accompany this can adversely influence breastfeeding (Brown *et al.*, 2015), a process which is heavily driven by psychological and social factors (Li *et al.*, 2008; Avery *et al*., 2009; Thulier and Mercer, 2009; Bloomfield and Kendall, 2012; Byrne *et al.*, 2014; Brown *et al.*, 2015). In this study, post-partum body shape concern was associated with breastfeeding. Consistent with other research, mothers with no body shape concern at four months post-partum breastfed significantly longer than those who had body shape concern at this time (Foster *et al.*, 1996; Barnes *et al.*, 1997; Brown *et al.*, 2015). Mothers who have a negative relationship with their own body may struggle with the physically intimate nature of breastfeeding and therefore may be less likely to persist with breastfeeding over the longer term (Earle, 2002).

Also in line with other research, body shape concern was associated with pre-pregnancy BMI, where overweight and obese mothers breastfed for a shorter duration (Amir and Donath, 2007; Donath and Amir, 2008; Li *et al.*, 2008). Mothers who have a negative perception of their body and who are also overweight, can not only have a more complex emotional relationship with breastfeeding, but can also face more feeding challenges as a direct result of their weight (Donath and Amir, 2008). Excess body weight can decrease milk production (Rasmussen, 2007) and make the already challenging practical and social aspects of breastfeeding, such as positioning, latching and feeding in public, even more challenging.

Consistent with other research (Oddy *et al.*, 2006; Scott *et al.*, 2006; Donath and Amir, 2008; Duncombe *et al.*, 2008; Clark *et al.*, 2009), having an overweight BMI at conception and some degree of body shape concern after pregnancy reduced breastfeeding duration. Strategies which help women to attain a healthy BMI prior to conception, which educate women on a healthy body weight after pregnancy, and which provide support to overweight mothers wishing to breastfeed, are needed.

4.5.5 *Strengths and limitations of this study*

Before drawing conclusions, the study strengths and limitations must be considered. The data presented were collected as part of a longitudinal observational study conducted by one researcher in Dublin and its surrounding counties.

Strengths of the study include the lack of inter-observer variation, consistent categorisation of reported milk feeding practices (WHO, 2004) and the use of validated instruments to measure maternal wellbeing. The TPDS is a validated instrument for the measurement of distress in pregnancy (Pop *et al.*, 2011). The instrument is user-friendly and has been shown to detect negative emotions in pregnancy towards confinement, delivery, general health and perceived partner involvement (Pop *et al.*, 2011). The MABISC is a validated instrument for the measurement of post-partum distress (Hackney *et al*., 1996; Høivik *et al.*, 2013). It has been shown to have satisfactory internal consistency and convergent validity with the more widely used Edinburgh Post-partum Depression Scale (EPDS) and Post-partum Bonding Questionnaire (PBQ) (Høivik *et al.*, 2013). Although the EPDS and PBQ are more helpful for the detection of the most serious maternal distress and rejection problems (Cox *et al.*, 1987; Brockington *et al.*, 2006; Høivik *et al.*, 2013), the MABISC was suitable for use in this study due to its brevity and the inoffensive phrasing of its items. The 8-item BSQ is a validated alternate form of the original 34-item BSQ and has showed equivalent means and excellent internal consistency with the 34-item BSQ (Evans and Dolan, 1993). This makes it suitable for use in studies where body disparagement is not the main focus of investigation and speed of questionnaire completion is important.

The study limitations must also be considered. Causal inferences cannot be made due to the observational study design (Grimes and Schulz, 2002). The results are not nationally representative and the study population consists only of Caucasian women of Irish or British nationality. As already outlined, instruments specific to pregnancy and the post-partum period were used to measure wellbeing where possible; however, the instrument (Evans and Dolan, 1993) used to measure body shape concern was not specifically designed for a pregnant or postnatal population. This was due to a lack of published instruments which measured body shape concern in pregnancy at the time of study design. However, Brown *et al.* (2015) recently published an instrument to measure body shape concern in pregnancy; the use of this specific instrument in research may yield more helpful insights into antenatal body shape concern.

4.6 Contribution to the literature

Bearing the study limitations in mind, this is one of the first studies in Ireland to provide insights into the relationship between maternal wellbeing and breastfeeding practices. Several noteworthy associations were seen between maternal wellbeing and breastfeeding outcomes in this study. Given that many of the associations seen are to the detriment of maternal wellbeing and breastfeeding, further investigation into maternal wellbeing could provide valuable insights into how the breastfeeding experience amongst mothers in Ireland could be improved.

In addition to further investigation into a woman's wellbeing, future research should investigate a woman's perception of partner involvement in the post-partum period. Perceived suboptimal partner involvement in pregnancy negatively impacted breastfeeding outcomes in this study. Therefore, investigation into the caring roles adopted, or not adopted, by a woman's support network could also provide useful direction for the development of guidance which enhances the breastfeeding experience.

4.7 Conclusion

A woman's breastfeeding journey starts long before the birth of her infant. Adequate physical, emotional and practical preparation for the commencement of breastfeeding is paramount to its successful initiation and maintenance (Fox *et al.*, 2015). Women can be educated on the technicalities of breastfeeding and helped to attain and maintain a healthy body and frame of mind prior to giving birth. If this preparation amongst women is further bolstered by a well-prepared maternal support network, then the entire family can approach breastfeeding in an informed manner which safeguards the wellbeing of mother and infant, and in so doing, safeguards breastfeeding.

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5.1 Introduction

5.1.1 Existing literature

Feeding practices established in the first year of life significantly impact long-term eating habits and physical health, making this particular year of life an especially important one for development (Barker *et al.*, 2002; Barker *et al.*, 2006; United Nations Standing Committee on Nutrition, 2006). Having examined aspects of milk feeding in **chapter four**, this chapter will progress to examining aspects of complementary feeding and vitamin D supplementation in infancy.

Complementary feeding refers to the introduction of foods other than breast milk or formula milk into the infant diet (Agostoni *et al.*, 2008). This term is used interchangeably with the term *weaning* in this thesis. The period during which an infant is weaned on to complementary food is necessary for nutritional and developmental reasons (Agostoni *et al.*, 2008). As an infant nears six months of age, the volume of milk consumed becomes insufficient to meet their nutritional needs, thus necessitating the introduction of additional sources of nutrition to support optimal growth and development (Kramer and Kakuma, 2004). Therefore, current recommendations state that complementary feeding should ideally commence close to 26 weeks of age, but no earlier than 17 weeks of age (Food Safety Authority of Ireland [FSAI], 2011).

Complementary feeding is not only important for nutritional reasons, but also for developing taste preferences (Butte, 2009; Horodynski *et al.*, 2011). Infants are genetically predisposed to prefer sweet and salty tastes (Agostoni *et al.*, 2008), which are generally associated with high-sugar and high-fat foods. It is important that such innate taste preferences are attenuated by the consumption of plainer foods throughout weaning, in an effort to promote healthier growth and development (Alvisi *et al.*, 2015).

Food behaviours are also developed as complementary feeding progresses. Infants must be helped to foster their ability to self-regulate their food intake and to appropriately respond to hunger cues, in order to establish a healthy pattern of weight gain (Hittner and Faith, 2011). Therefore, since the first year of life can set the tone for lifelong taste preferences and food behaviours (Agostoni *et al.*, 2008), it is important that socialisation towards food in infancy is examined alongside nutritional intakes.

While an infant's food intake should ideally meet all of their nutritional needs, one specific nutrient has been identified as lacking in the diets of infants in Ireland (FSAI, 2007). Vitamin D is essential for healthy bone development (Gallo *et al.*, 2012), but both vitamin D deficiency and insufficiency in infancy have been identified in recent years (FSAI, 2007) resulting in the recommendation that all infants consume five micrograms of vitamin D by supplementation each day from birth to their first birthday (FSAI, 2007; Health Service Executive [HSE], 2010).

5.1.2 Knowledge gaps

Early feeding experiences can have far-reaching consequences on health (Butte, 2009), and so this phase of feeding has received much attention in the literature. In particular, the timing of weaning (Allcutt and Sweeney, 2010; Tarrant *et al.*, 2010; Dominguez Castro *et al.*, 2014) and the appropriateness of the foods consumed (Tarrant *et al.*, 2010; O'Donovan *et al.*, 2015) have been of interest. However, changes in infant feeding practices over time should continue to be recorded, and so, this study will record the timing and appropriateness of first foods consumed. This study will also assess the suitability of foods consumed towards the end of the first year of life, an age which has received less attention in the literature (Irish Universities Nutrition Alliance [IUNA], 2012). This study will also explore aspects of maternal infant feeding style and infant socialisation towards food, topics which have received very little attention to date.

Finally, compliance with recommendations for vitamin D supplementation in infancy (FSAI, 2007; HSE, 2010) has not been assessed, and so this study will examine the adequacy of vitamin D supplementation practices in infancy.

5.2 Aims and objectives

The aim of this study was to obtain a detailed picture of diet and supplementation practices amongst a sample of 12-month-old infants. The objectives were to explore the:

- Weaning practices in a sample of 158 infants at four, nine and 12 months of age;
- Adequacy of the nutritional intakes of a sample of 12-month-old infants;
- Factors associated with maternal feeding style at 12 months post-partum;
- Vitamin D supplementation practices at four, nine and 12 months of age; and
- Factors associated with recommended vitamin D supplementation in infancy.

5.3 Methodology

This chapter focused on data from 158 mother-infant dyads. Only mother-infant dyads on whom data were obtained at five points (pregnancy, birth and four, nine and 12 months post-partum) were included for analysis. The study design and follow-up of participants are described in **chapter two**, **sections 2.6 to 2.10**. The sociodemographic and maternal and infant health characteristics are described in **chapter three**.

5.3.1 Assessment of general feeding practices

Quantitative questionnaires were completed by mothers at four (Appendix 11), nine (Appendix 14) and 12 (Appendix 17) months post-partum. Data were collected on the infant diet, to include: age (in weeks) at which weaning commenced, use of standard *versus* baby-led weaning, number of meals and snacks consumed per day, main food textures provided, common snacks consumed and vitamin D supplementation practices.

5.3.2 Assessment of maternal feeding style

A validated adapted version (Brown and Lee, 2011) of the Child Feeding Questionnaire (CFQ) (Birch *et al.*, 2001) was used to assess maternal feeding style. The CFQ evaluates parental beliefs and practices towards their child's diet (Birch *et al.*, 2001), and the adapted version used in this study is detailed in **chapter two**, **section 2.10.3**.

5.3.3 *Assessment of infant food intake*

Food diaries in which infant food intake was recorded, using household measures, over two days were used to assess nutrient intakes at 12 months of age. Mothers recorded the following in the infant food diary (Appendix 18):

- Time and category of eating occasion, *e.g.* breakfast, lunch, dinner, or snack;
- Source of food, *i.e.* homemade or commercially ready-prepared;
- Food eaten, to include food brand, where applicable;
- Volume of food eaten, as estimated by standard household measures;
- Cooking method used, if applicable; and
- Additions to food, if applicable, *e.g.* butter, sugar, salt, gravy.

Data from the food diaries for 12-month-old infants were first entered into *Nutritics* Nutrition Analysis Software (*Nutritics*, Dublin, Ireland) for nutrient analysis. This software provides a comprehensive and up-to-date database of over 125,000 foods. The database is compiled from sources such as the United Kingdom's Composition of Foods Integrated Dataset (Public Health England, 2015), which includes all foods from the 7th edition of McCance and Widdowson's "The Composition of Foods" (Finglas *et al.*, 2014). The *Nutritics* database also encompasses foods from databases such as the Irish Food Composition Database (Black *et al.*, 2011) and the most recent version (release 28) of the National Nutrient Database for Standard Reference (United States Department of Agriculture, 2015). The vast majority of foods in this study inputted into *Nutritics* were contained with its existing database. However, for speciality infant food items not included in the existing database, the researcher had the facility to manually add the nutritional information of these foods from the food label to the database.

Once all foods from the two-day food diaries had been inputted, the mean energy and nutrient intakes were calculated by the software and the resulting figures were entered into SPSS for Windows, version 22.0 (IBM, New York, United States).

5.3.4 Definitions for food intake

Appropriateness of weaning: Current recommendations state that infants should be weaned between 17 and 26 weeks of age (FSAI, 2011); therefore, appropriate weaning was defined as the introduction of food other than breast milk or formula milk between 17 and 26 weeks of age, inclusive.

Baby-led weaning: Mothers who used purées and spoon-feeding 10% of the time or less were assigned to the baby-led weaning (BLW) category (Brown and Lee, 2011).

Meal: Meals were defined by time of day (Tarrant *et al.*, 2010). A routine meal consumed: between waking and midday was *breakfast*; between midday and 3pm was *lunch*; and between 3pm and 6pm was the *evening meal*.

Snack: A snack was any sweet or savoury food offered between routine meal times.

Food texture: Mothers were asked to select the predominant texture of the food consumed by their infant at nine and at 12 months of age. The categories from which they had to choose were: puréed and runny; soft and smooth; soft and lumpy; mashed and minced; and roughly chopped (Tarrant *et al.*, 2010).

5.3.5 Statistical analysis

IBM SPSS for Windows, version 22.0 (IBM, New York, United States) was used to analyse the data obtained from quantitative questionnaires and infant food diaries. Statistical significance was taken at $p<0.05$.

Descriptive statistics

Normally distributed data were summarised numerically using the mean and standard deviation (SD). Non-normally distributed data were summarised numerically using the median and interquartile range (IQR).

Univariate and multivariate analyses

For continuous normally distributed variables, the comparison of means for two different groups was assessed using an Independent Samples *t*-test. For non-normally distributed continuous variables, the comparison of means for two different groups was assessed using the Mann-Whitney *U* test. Associations between categorical variables were assessed using cross-tabulations and the Chi-squared statistics test assessed statistical significance. Yates' Continuity Correction was used for 2x2 contingency tables to improve the Chi-square approximation (Field, 2013).

Independent variables which were significant in univariate analyses were included in multivariate analyses. Maternal age and education level were also included, regardless of significance level, due to the precedence in the literature for their influence on this particular topic (Ogden *et al.*, 2006; Orrell-Valente *et al.*, 2007).

Before multivariate analyses were conducted, multicollinearity between variables was assessed. To avoid multicollinearity, correlations were conducted between independent variables to ensure that the Pearson correlation coefficient was <0.9. If the Pearson correlation coefficient was greater than 0.9, the more appropriate of the two variables was included. Tabachnick and Fidell's (2007) formula was used to ensure that an acceptable number of independent variables were entered into each model.

Standard multiple regression and binary logistic regression were performed. Standard multiple regression was used to produce three models to predict the elements of a restrictive maternal feeding style. The dependent variable was the score for a restrictive subscale of the CFQ, *i.e.* pressure to eat, restriction or monitoring.

Once the analyses had been performed, the usefulness of the model produced was assessed (Pallant, 2010). The Normal Probability Plot and the Scatterplot of the standardised residuals were first inspected to identify any outliers, or cases with a standardised residual value of greater than 3.3 or less than -3.3. The Adjusted R Square value indicated how much of the variance in the dependent variable was explained by the model. The Beta values were then assessed to compare the contribution of each independent variable to the model, and to identify which variable made the strongest unique contribution to explaining the dependent variable. The significance value of each independent variable was also recorded.

Binary logistic regression was used to predict recommended vitamin D supplementation practices at four, nine and 12 months of age. The Forced Entry Method was used, whereby all predictor variables were tested in one block to assess their predictive ability while controlling for the effects of other predictors in the model (Pallant, 2010). To predict recommended vitamin D supplementation, the codes for the dependent variable in analysis were: *1 = supplementing with vitamin D as recommended* and *0 = not supplementing with vitamin D as recommended*.

Once the analyses had been performed, the usefulness of the model was assessed (Pallant, 2010). The Hosmer-Lemeshow Goodness of Fit Test was checked to ensure that $p>0.05$, to indicate support for the model. The Cox & Snell R Square and the Nagelkerke R Square values provided an indication of the amount of variation in the dependent variable which was explained by the model (Pallant, 2010).

The significance value produced by the Wald test for each independent variable in the model was checked. Variables with a significance value of <0.05 significantly predicted the dependent variable, *i.e.* recommended vitamin D supplementation.

To further interpret results, the B values produced were also documented. A positive B value indicated that an increase in the independent variable score resulted in an increased probability of a case recording a score of one in the dependent variable (*i.e.* recommended vitamin D supplementation). The Exp (B) value, or odds ratio (OR), and the 95% confidence interval (CI) were recorded for each independent variable. Finally, the ZResid values were assessed to identify outliers within the sample.

5.4 Results

5.4.1 Maternal and infant characteristics

The sociodemographic characteristics and health-related behaviours of women (*n*158) who were recruited in pregnancy and followed-up until their infant was one year old are outlined in **Table 5.1**.

Table 5.1 Sociodemographic characteristics and health-related behaviours of 158 women in pregnancy and throughout the first year post-partum

		n	%
Highest education level	Second-level education	38	24.1
	Vocational qualification	17	10.8
	Third level degree	103	65.2
Parity	Nulliparous	68	43.0
	Multiparous	90	57.0
Smoker	At conception	51	32.3
	All throughout pregnancy	13	8.2
	4 months post-partum	19	12.0
	9 months post-partum	22	13.9
	12 months post-partum	24	15.2
Consumed any alcohol	During pregnancy	35	22.2
	4 months post-partum	131	82.9
	9 months post-partum	138	87.3
	12 months post-partum	136	86.1

Almost three-quarters (73.4%, *n*116) of these women planned their pregnancy and almost all (99.4%, *n*157) supplemented with folic acid, but less than a third (32.3%, *n*51) supplemented with folic acid in line with recommendations.

The mean age of women in this sample who gave birth was 32.0 (SD ± 4.9) years. The mean gestational age of infants born to these mothers was 40.3 (SD ± 1.2) weeks. Almost two-thirds (65.2%, *n*103) of mothers in this sample initiated breastfeeding. The median duration of any breastfeeding was 70 (IQR 14, 182) days, and of those mothers who breastfed (*n*105), almost a quarter (23.8%, *n*25) did at least some, if not exclusive, breastfeeding for 26 weeks.

The birth-related characteristics and methods of infant milk feeding initiated amongst this sample of mothers are shown in **Table 5.2**.

Table 5.2 Birth-related and milk feeding characteristics of 158 mothers

		n	%
Maternal age at delivery	≤24 years	13	8.2
	25-35 years	104	65.8
	≥36 years	41	25.9
Mode of delivery	Vaginal delivery	120	75.9
	Caesarean section	38	24.1
First milk	Breast milk	103*	65.2
	Formula milk	55	34.8
Breastfeeding duration	<2 months	56	53.3
	2-4 months	18	17.1
	>4 months	31	29.5

≤: Less than or equal to **≥:** Greater than or equal to **<:** Less than **>:** Greater than

* Due to a medical emergency following labour, two mothers were unable to breastfeed for the first feed; formula milk was provided instead. However, each infant later received breast milk upon the recovery of their mother, resulting in 66.5% (*n*105) of infants receiving breast milk at least once

5.4.2 Initiation of weaning

Over three-quarters (78.5%, *n*124) of mothers received advice on weaning from a health professional before 17 weeks post-partum. The mean age of weaning on to solid food was 20.7 (SD ± 4.6) weeks. The majority (93.8%, *n*152) of mothers followed a standard weaning approach, with only 6.2% (*n*10) taking a baby-led approach to weaning. While 13.9% (*n*22) of infants were weaned on to solid food before 17 weeks of age, the vast majority (86.1%, *n*136) were weaned between 17 and 26 weeks of age.

Table 5.3 compares the characteristics of mothers who weaned their infant before they were 17 weeks old with the characteristics of mothers who weaned their infant at or after 17 weeks of age. When compared with mothers who weaned their infant on to solid food at or after 17 weeks of age, mothers who weaned their infant before 17 weeks of age were significantly less likely to initiate breastfeeding, and of those who did breastfeed, they breastfed for a significantly shorter duration (**Table 5.3**).

In addition to the characteristics outlined in **Table 5.3**, the following characteristics were not significantly different between the groups: smoking throughout pregnancy; alcohol consumption in pregnancy; relative deprivation; and gestational age.

Table 5.3 Comparisons between mothers who weaned their infant before 17 weeks of age with those who weaned their infant at or after 17 weeks of age

	Weaned before 17 weeks of age (*n*22)		Weaned at or after 17 weeks of age (*n*136)		*p*-value*
	n	Mean ± SD	*n*	Mean ± SD	
Maternal age at delivery (years)	22	30.4 ± 4.8	136	32.3 ± 4.9	0.10‡
Birth weight (grams)	22	3515.3 ± 446.0	136	3550.3 ± 434.1	0.73‡
	n	Median (IQR)	*n*	Median (IQR)	
Duration of any breastfeeding (days)	9	17.0 (2.5, 80.0)	89	77.0 (14.0, 189.0)	**0.05∫**
	n	%	*n*	%	
Maternal education					
Third level education	11	50.0	92	67.6	0.17†
No third level education	11	50.0	44	32.4	
Planned pregnancy					
Yes, planned	15	68.2	101	74.3	0.74†
No, unplanned	7	31.8	35	25.7	
Parity					
Nulliparous	10	45.5	58	42.6	0.99†
Multiparous	12	54.5	78	57.4	
Smoking status at conception					
Smoking	9	40.9	42	30.9	0.49†
Not smoking	13	59.1	94	69.1	
Maternal health insurance					
Public	14	63.6	95	69.9	0.74†
Semi-private	8	36.4	41	30.1	
Medical card holder					
Yes, has a medical card	4	18.2	21	15.4	0.99†
No medical card	18	81.8	115	84.6	
Correct folic acid supplementation					
Yes, supplemented	6	27.3	45	33.1	0.77†
No, did not supplement	16	72.7	91	66.9	
Maternal body mass index					
≤24.9kg/m^2	12	54.5	67	49.3	0.82†
≥25.0kg/m^2	10	45.5	69	50.7	
Gender					
Male	6	27.3	62	45.6	0.17†
Female	16	72.7	74	54.4	
First milk					
Breast milk	8	36.4	88	64.7	**0.02†**
Formula milk	14	63.6	48	35.3	
Any breast milk on discharge					
Yes	7	31.8	76	55.9	**0.05†**
No	15	68.2	60	44.1	

* *p*-value of <0.05 was significant **SD:** Standard deviation **IQR:** Interquartile range

‡ Association between normally distributed continuous data assessed using an Independent Samples *t*-test

∫ Association between non-normally distributed continuous data assessed using a Mann-Whitney *U* test

† Association between categorical variables assessed using the chi-squared test with Yates' Continuity Correction for 2x2 contingency tables

5.4.3 Infant diet at 12 months of age: food, fluids and nutrient intakes

Number of meals at 12 months of age

At 12 months of age, infants (*n*158) were consuming a median of three main meals and two snacks daily.

Texture of meals at 12 months of age

At nine months of age, infants were predominantly consuming foods of a *soft and lumpy* (41.8%, *n*66) or *mashed and minced* (33.5%, *n*53) texture (**Figure 5.1**). However, a greater proportion of infants had progressed to more advanced textures by 12 months of age (**Figure 5.1**), with half (49.4%, *n*78) consuming foods of a *mashed and minced* texture, and a third (34.8%, *n*55) consuming foods of a *roughly chopped* texture.

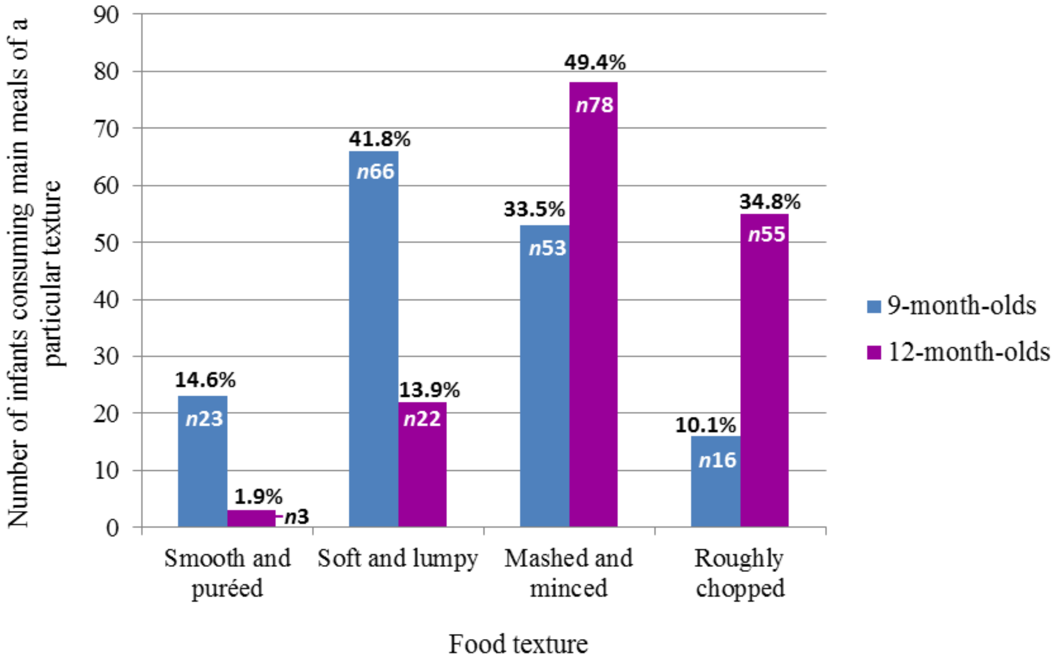

Figure 5.1 Progression in food textures between 9 and 12 months of age

Additions to meals at 12 months of age

Almost three-quarters (72.2%, *n*114) of mothers added condiments to meals for their 12-month-old infant (**Figure 5.2**). Butter (75.4%, *n*86) and infant-specific stock (58.8%, *n*67) were most commonly added to meals.

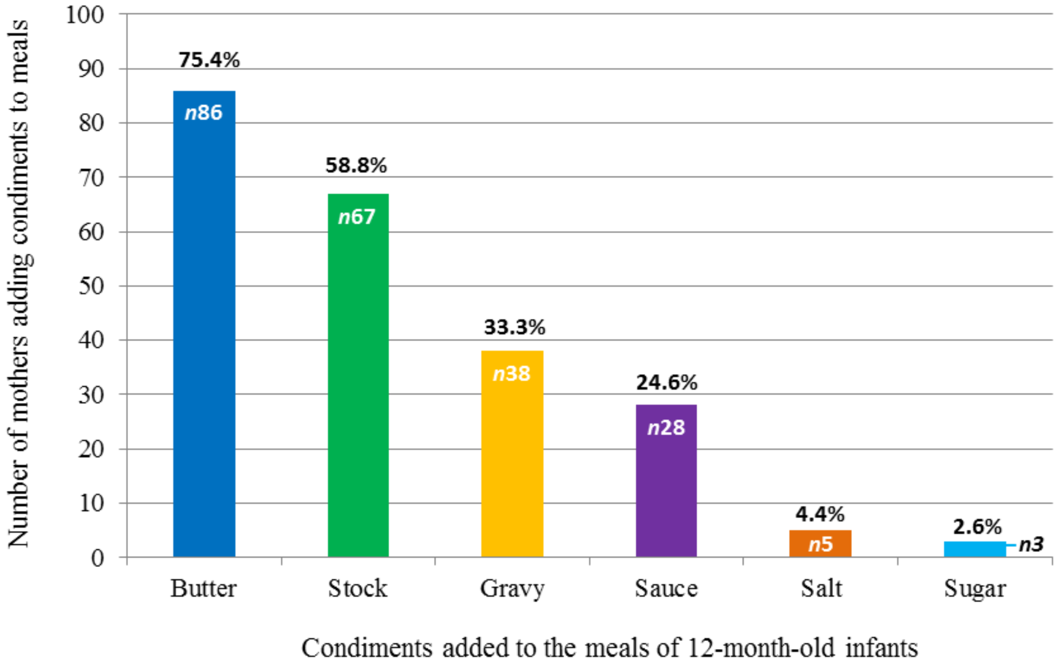

Figure 5.2 Condiments added to infant meals by 114 mothers

Snacks at 12 months of age

Most (98.1%, *n*155) infants were consuming at least one snack per day. The snacks consumed more than once weekly are shown in **Table 5.4**.

Table 5.4 Snacks consumed at least once weekly by 155 infants

	n	%		*n*	%
Yogurt	155	100.0	Bread and butter	85	54.8
Fruit	138	89.0	Vegetables	66	42.6
Rusks, rice cakes and crackers	118	76.1	Chocolate and ice-cream	41	26.5
Biscuits	104	67.1	Bread and jam	26	16.8
Cheese	94	60.6	Crisps	25	16.1

Fluids at 12 months of age

At 12 months of age, the most commonly consumed main milk drink was formula milk (51.9%, *n*82) (**Figure 5.3**). Cow milk was the main milk drink for less than a quarter (22.8%, *n*36) of infants, and a further 22 (13.9%) infants had started consuming cow milk as a drink, but not as their main milk drink. Of the remaining 100 infants who were not consuming cow milk as a drink, 28% (*n*28) of mothers planned to introduce cow milk as a drink before the infant turned 13 months of age, while 72% (*n*72) of mothers did not.

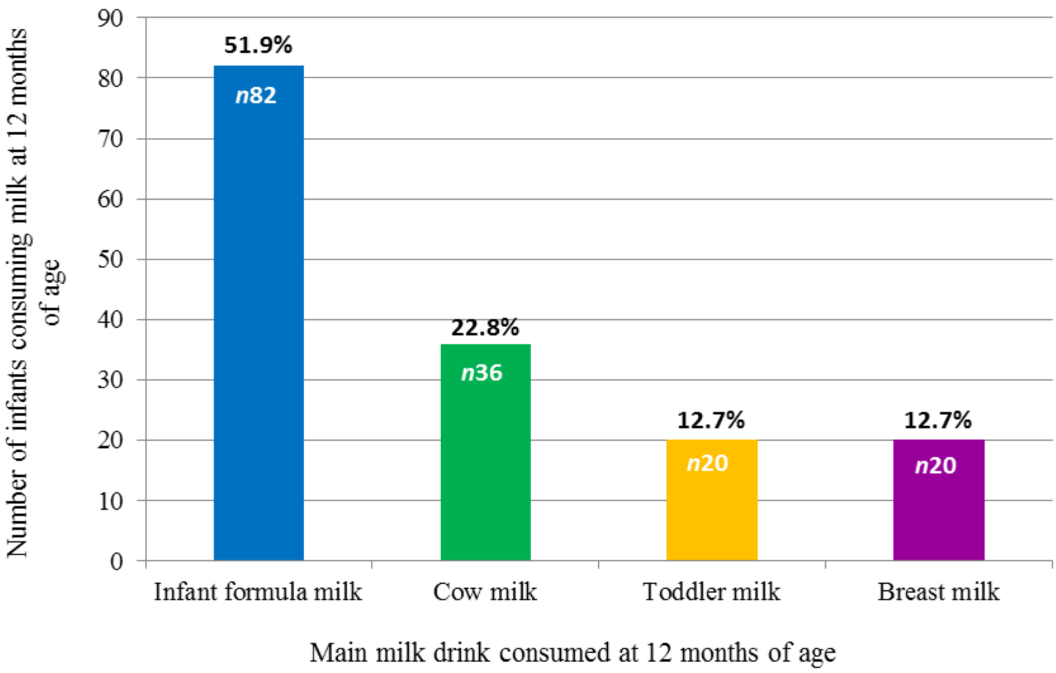

Figure 5.3 Main milk drink consumed by 158 infants at 12 months of age

Infants consumed milk on a mean of three occasions per day and consumed a daily mean of 503.4 (SD ± 171.8) millilitres (mls) of milk. However, 18.4% (*n*29) of mothers reported that their infant consumed in excess of 600mls of milk daily and only 17.1% (*n*27) of 12-month-old infants were drinking fluids from a rim, or lidless beaker.

A third (32.9%, *n*52) of infants consumed fluids other than milk or water. These fluids included standard fruit juice, baby fruit juice and dilute fruit drinks.

Nutrient intakes at 12 months of age

Daily nutrient intakes amongst a sample of 153 infants are provided in **Table 5.5a**. Infants consumed a mean of 226.6 (SD ± 137.5) kilocalories (kcals) above recommended intakes and a median of 25.9 (IQR 19.4, 32.4) grams (g) of protein above recommended intakes.

Table 5.5a Nutrient intakes amongst 153 Irish infants at 12 months of age

Nutrient	Measure of intake	Recommended daily intake	Recorded intake
			Median (IQR)
Protein	Grams (g)	14.9g/day†	41.0 (34.0, 47.5)
			Mean ± SD
Energy	Kilojoules (kJ)	333kJ/kg*	3965.2 ± 622.2
Energy	Kilocalories (kcal) ± SD	72kcal/kg*	944.6 ± 139.4
Saturated fat	Grams	-	16.6 ± 4.9
Monounsaturated fat	Grams	-	6.9 ± 3.4
Polyunsaturated fat	Grams	-	2.4 ± 1.2
Sodium	Milligrams (mg) ± SD	350mg†	681.5 ± 266.4
Calcium	Milligrams (mg) ± SD	525mg†	831.0 ± 237.9
Iron	Milligrams (mg) ± SD	7.8mg†	8.4 ± 4.1
Vitamin D	Micrograms (μg) ± SD	10.0μg‡	7.6 ± 4.7
			% of total energy
Carbohydrate	Grams	35-45% of total energy†	47.8%
Fat	Grams	30-40% of total energy†	35.0%

IQR: Interquartile range **SD:** Standard deviation **Kg:** Kilogram

* Dietary Reference Values for Energy, Scientific Advisory Committee on Nutrition, 2011

† Recommended Dietary Allowances for Infants, Food Safety Authority of Ireland, 1999

‡ Dietary Reference Intakes, Institute of Medicine, 2010

Protein, carbohydrate and fat represented 17.2% (median intake of 41.0g), 47.8% (mean intake of 118.3 ± 22.1g) and 35.0% (mean intake of 36.8 ± 8.4g) of total energy intakes, respectively.

Average daily intakes of sodium, calcium and iron exceeded recommended intakes (**Table 5.5a**). Sodium intakes, at 681.5 milligrams (mg), were almost double the recommended daily intake of 350mg for 12-month-olds. Vitamin D intakes did not meet recommendations (**Table 5.5a**). When vitamin D provided via supplementation was included, the mean daily intake was 7.6 (SD ± 4.7) micrograms (μg) (**Table 5.5a**). The mean daily intake of vitamin D solely from food sources was 6.3 (SD ± 4.4) μg.

Gender differences in nutrient intakes were also examined (**Table 5.5b**). When compared with female infants, male infants consumed significantly more kilocalories, carbohydrate, fat, iron and vitamin D.

Table 5.5b Gender differences in daily nutrient intakes amongst 153 12-month-old infants

Nutrient	Measure of intake	Male *n*68	Female *n*85	*p*-value*
		Median (IQR)	Median (IQR)	
Protein	Grams (IQR)	42.0 (36.0, 48.8)	41.0 (34.0, 47.0)	0.73‡
		Mean ± SD	Mean ± SD	
Energy	Kilocalories	991.7 ± 151.8	920.9 ± 128.9	**<0.01†**
Carbohydrate	Grams	123.3 ± 24.4	115.3 ± 20.4	**0.03†**
Fat	Grams	39.4 ± 9.4	35.5 ± 7.6	**<0.01†**
Saturated fat	Grams	17.5 ± 5.1	16.4 ± 4.9	0.15†
Monounsaturated fat	Grams	7.4 ± 3.7	7.0 ± 3.2	0.55†
Polyunsaturated fat	Grams	2.5 ± 1.5	2.5 ± 1.2	0.92†
Sodium	Milligrams	681.6 ± 266.0	690.2 ± 266.3	0.84†
Calcium	Milligrams	836.0 ± 228.0	833.9 ± 247.4	0.96†
Iron	Milligrams	9.4 ± 5.1	7.6 ± 2.8	**<0.01†**
Vitamin D	Milligrams	8.5 ± 4.6	6.9 ± 4.5	**0.03†**

* *p*-value <0.05 was significant **SD:** Standard deviation **IQR:** Interquartile range

† Association between normally distributed continuous data assessed using an Independent Samples *t*-test

‡ Association between non-normally distributed continuous data assessed using a Mann-Whitney *U* test

5.4.4 Maternal feeding style

Mothers completed an adapted version of the CFQ (Brown and Lee, 2011) at 12 months post-partum. The mean scores for each subscale (minimum score = 1, maximum score = 5) of the CFQ are provided in **Table 5.6**. The subscales representing a *controlling* feeding style were further examined, *i.e.* pressure to eat, restriction and monitoring.

Table 5.6 Mean scores for the Child Feeding Questionnaire subscales amongst 158 mothers

Subscale	Mean ± SD	Subscale	Mean ± SD
Perceived responsibility	4.5 ± 0.52	Restriction	3.9 ± 0.81
Concern for child weight	2.2 ± 1.11	Monitoring	4.3 ± 0.88
Pressure to eat	2.4 ± 0.87	Perceived parental weight	3.1 ± 0.32

SD: Standard deviation

Univariate analyses were conducted to explore the factors which were related to these subscales (**Table 5.7a-c**). Predictors of *pressure to eat* were first examined (**Table 5.7a**). Mothers had significantly higher scores on the *pressure to eat* subscale if they had been distressed in pregnancy or were not breastfeeding at four months post-partum.

Table 5.7a Factors associated with the **pressure to eat subscale** on the adapted Child Feeding Questionnaire

		n	Mean ± SD†	*p*-value*
Maternal third level education	Yes	103	2.42 ± 0.93	0.53
	No	55	2.46 ± 0.76	
Medical card holder	Yes	25	2.25 ± 0.81	0.28
	No	133	2.47 ± 0.88	
Planned pregnancy	Yes	116	2.43 ± 0.82	0.93
	No	42	2.43 ± 1.00	
Stress in pregnancy	Significantly stressed	41	2.68 ± 0.92	**0.04**
	Not stressed	117	2.34 ± 0.84	
Smoked in all 3 trimesters	Yes	13	2.80 ± 1.20	0.21
	No	145	2.40 ± 0.83	
Smoking at 12 months post-partum	Yes	24	2.59 ± 1.10	0.61
	No	134	2.41 ± 0.83	
Parity	Nulliparous	68	2.52 ± 0.92	0.33
	Multiparous	90	2.37 ± 0.83	
Milk feeding at birth	Breastfeeding	96	2.41 ± 0.87	0.60
	Formula feeding	62	2.47 ± 0.87	
Milk feeding at 4 months post-partum	Breastfeeding	38	2.14 ± 0.72	**0.02**
	Formula feeding	120	2.53 ± 0.90	
Milk feeding at 9 months post-partum	Breastfeeding	22	2.17 ± 0.73	0.14
	Formula feeding	136	2.48 ± 0.90	
Milk feeding at 12 months post-partum	Breastfeeding	20	2.14 ± 0.76	0.10
	Formula feeding	138	2.48 ± 0.88	
Rapid growth in the first year of life	Yes	45	2.48 ± 0.92	0.81
	No	113	2.42 ± 0.85	
Non-parental childcare	Yes	98	2.35 ± 0.85	0.09
	No	60	2.58 ± 0.89	
Infant sleep per night at 12 months	Adequate, 12-14 hours	95	2.44 ± 0.91	0.99
	Inadequate, <12 hours	63	2.43 ± 0.81	

* *p*-value <0.05 was significant **SD:** Standard deviation <: Less than

† Association between normally distributed continuous data assessed by an Independent Samples *t*-test

A multivariate linear regression model (R^2=0.08, F=2.17, *p*=0.04) which included six characteristics (maternal age; third level education; smoked throughout pregnancy; antenatal stress; breastfeeding at four months post-partum; and kilocalories consumed at age one year) examined predictors of scores on the *pressure to eat* subscale. Pressure to eat was predicted by breastfeeding behaviour (β=-0.333, *t*=-1.96, *p*=0.05), where mothers who were breastfeeding at four months post-partum had lower scores on the *pressure to eat* subscale at 12 months post-partum.

Factors associated with the *restriction* subscale were also explored (**Table 5.7b**). In univariate analyses, medical card holders, mothers with an unplanned pregnancy or who were smokers had significantly lower restriction scores.

Table 5.7b Factors associated with the **restriction subscale** on the adapted Child Feeding Questionnaire

		n	Mean ± SD	*p*-value*
Maternal third level education	Yes	103	3.95 ± 0.82	0.42
	No	55	3.85 ± 0.78	
Medical card holder	Yes	25	3.57 ± 0.96	**0.05**
	No	133	3.97 ± 0.76	
Planned pregnancy	Yes	116	4.03 ± 0.73	**0.01**
	No	42	3.60 ± 0.94	
Stress in pregnancy	Significantly stressed	41	3.77 ± 0.82	0.18
	Not stressed	117	3.96 ± 0.80	
Smoked in all 3 trimesters	Yes	13	3.52 ± 0.69	**0.04**
	No	145	3.95 ± 0.81	
Smoking at 12 months post-partum	Yes	24	3.55 ± 0.69	**0.01**
	No	134	3.98 ± 0.81	
Parity	Nulliparous	68	3.96 ± 0.69	0.80
	Multiparous	90	3.88 ± 0.89	
Milk feeding at birth	Breastfeeding	96	3.88 ± 0.81	0.50
	Formula feeding	62	4.00 ± 0.80	
Milk feeding at 4 months post-partum	Breastfeeding	38	3.93 ± 0.82	0.70
	Formula feeding	120	3.87 ± 0.77	
Milk feeding at 9 months post-partum	Breastfeeding	22	3.92 ± 0.81	0.96
	Formula feeding	136	3.91 ± 0.81	
Milk feeding at 12 months post-partum	Breastfeeding	20	3.85 ± 0.81	0.71
	Formula feeding	138	3.92 ± 0.81	
Rapid growth in the first year of life	Yes	45	3.91 ± 0.79	0.83
	No	113	3.91 ± 0.82	
Non-parental childcare	Yes	98	3.89 ± 0.84	0.74
	No	60	3.95 ± 0.75	
Infant sleep per night at 12 months	Adequate, 12-14 hours	95	3.91 ± 0.81	0.95
	Inadequate, <12 hours	63	3.91 ± 0.81	

* *p*-value <0.05 was significant   **SD:** Standard deviation   <: Less than

† Association between normally distributed continuous data assessed by an Independent Samples *t*-test

A multivariate linear regression model (R^2=0.08, F=2.31, *p*=0.04) which included seven characteristics (maternal age; third level education; kilocalories consumed by infant at age one year; medical card holder; unplanned pregnancy; smoked throughout pregnancy; and smoked at 12 months post-partum) examined predictors of scores on the *restriction* subscale. None of the characteristics included made a statistically significant contribution to the prediction of restrictive feeding practices.

Finally, predictors of *monitoring* were also examined (**Table 5.7c**). In univariate analyses, mothers caring for their infant full-time and mothers whose infant was sleeping <12 hours per night had significantly higher *monitoring* scores.

Table 5.7c Factors associated with the **monitoring subscale** on the adapted Child Feeding Questionnaire

		n	Mean ± SD	*p*-value*
Maternal third level education	Yes	103	4.28 ± 0.88	0.20
	No	55	4.42 ± 0.87	
Medical card holder	Yes	25	4.20 ± 0.97	0.37
	No	133	4.36 ± 0.86	
Planned pregnancy	Yes	116	4.29 ± 0.94	0.70
	No	42	4.44 ± 0.70	
Stress in pregnancy	Significantly stressed	41	4.21 ± 1.07	0.69
	Not stressed	117	4.37 ± 0.81	
Smoked in all 3 trimesters	Yes	13	4.44 ± 0.76	0.78
	No	145	4.32 ± 0.89	
Smoking at 12 months post-partum	Yes	24	4.40 ± 0.62	0.75
	No	134	4.32 ± 0.92	
Parity	Nulliparous	68	4.39 ± 0.87	0.35
	Multiparous	90	4.29 ± 0.89	
Milk feeding at birth	Breastfeeding	96	4.30 ± 0.84	0.56
	Formula feeding	62	4.38 ± 0.94	
Milk feeding at 4 months post-partum	Breastfeeding	38	4.41 ± 0.73	0.52
	Formula feeding	120	4.30 ± 0.92	
Milk feeding at 9 months post-partum	Breastfeeding	22	4.53 ± 0.81	0.25
	Formula feeding	136	4.30 ± 0.90	
Milk feeding at 12 months post-partum	Breastfeeding	20	4.53 ± 0.83	0.27
	Formula feeding	138	4.30 ± 0.89	
Rapid growth in the first year of life	Yes	45	4.30 ± 1.01	0.67
	No	113	4.35 ± 0.83	
Non-parental childcare	Yes	98	4.20 ± 0.96	**0.02**
	No	60	4.54 ± 0.68	
Infant sleep per night at 12 months	Adequate, 12-14 hours	95	4.20 ± 0.97	**0.05**
	Inadequate, <12 hours	63	4.53 ± 0.69	

* *p*-value <0.05 was significant   **SD:** Standard deviation   <: Less than

† Association between normally distributed continuous data assessed by an Independent Samples *t*-test

A multivariate linear regression model (R^2=0.12, F=3.37, p<0.01) which included six characteristics (maternal age; third level education; smoked throughout pregnancy; kilocalories consumed by infant at age one year; use of non-parental childcare; and adequate sleep at age one year) examined the predictors of scores on the *monitoring* subscale. The model indicated that monitoring at age one year was predicted by use of non-parental childcare (β=-0.342, t=-2.19, p=0.03) and kilocalories consumed by the infant (β=-0.002, t=-3.24, p<0.01), where lower scores on the *monitoring* subscale were associated with non-parental childcare and a higher kilocalorie intake.

Overall, mothers who were not breastfeeding at four months post-partum or who cared for their infant full-time exerted significantly more control over food intake.

5.4.5 Vitamin D supplementation at 12 months of age

It is recommended that infants receive a daily supplement of five micrograms of vitamin D from birth to 12 months of age (FSAI, 2007). Despite this, suboptimal supplementation practices were evident at each point of data collection (**Figure 5.4**).

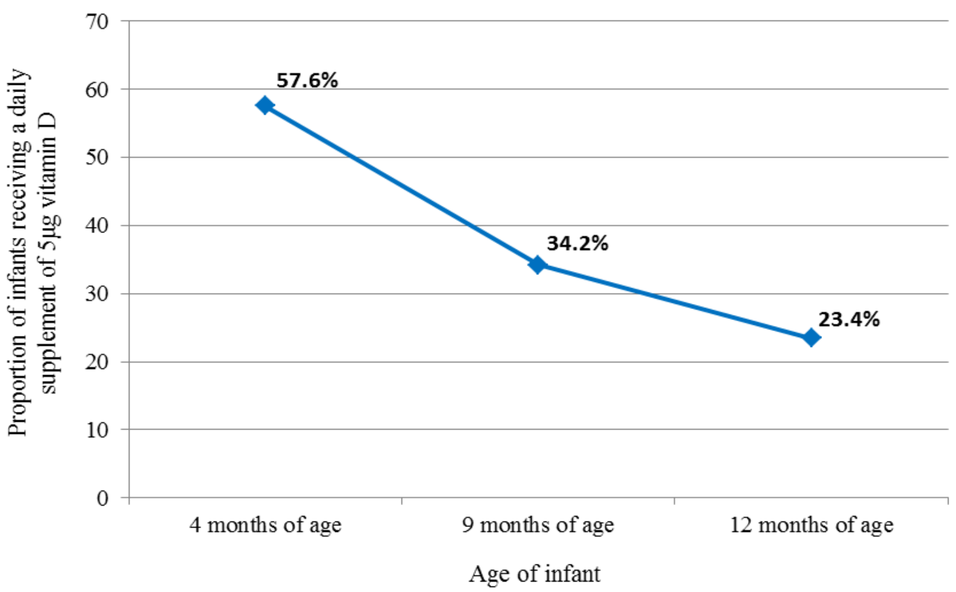

Figure 5.4 Proportion of infants receiving a daily supplement of 5 micrograms (µg) of vitamin D during the first year of life

Predictors of vitamin D supplementation practices

Predictors of recommended supplementation amongst four-month-old infants were first examined by univariate analyses (**Table 5.8a**).

Table 5.8a Comparisons between mothers who did and did not supplement their 4-month-old infant with 5 micrograms of vitamin D daily

	Supplemented with vitamin D as recommended[!] (n91)		Did not supplement with vitamin D as recommended[!] (n67)		p-value*
	n	Mean ± SD	n	Mean ± SD	
Maternal age (years)	91	31.8 ± 5.1	67	32.4 ± 4.6	0.34§
Age of weaning (weeks)	91	21.1 ± 4.9	67	20.1 ± 4.1	0.21§
	n	Median (IQR)	n	Median (IQR)	
Duration of breastfeeding (days)	58	63.0 (14.0, 182.0)	40	80.5 (9.5, 182.0)	0.81ꓤ
	n	%	n	%	
Maternal education					
Third level education	56	61.5	47	70.1	0.34†
No third level education	35	38.5	20	29.9	
Social class					
High	41	45.1	33	49.3	
Middle	42	46.2	26	38.8	0.60‡
Low	8	8.8	8	11.9	
Parity					
Nulliparous	43	47.3	25	37.3	0.28†
Multiparous	48	52.7	42	62.7	
Smoking status at conception					
Smoking	28	30.8	23	34.3	0.76†
Not smoking	63	69.2	44	65.7	
Smoked in all three trimesters	8	8.8	5	7.5	0.99†
Smoking at 4 months post-partum	11	12.1	8	11.9	0.99†
Consumed alcohol in pregnancy	18	19.8	17	25.4	0.52†
Correct folic acid supplementation[¡]	33	36.3	18	26.9	0.28†
First milk					
Breast milk	56	61.5	40	59.7	0.95†
Formula milk	35	38.5	27	40.3	
Vitamin D advice from a HCP					
Yes	89	97.8	38	56.7	**<0.01**†
No	2	2.2	29	43.3	

SD: Standard deviation **IQR:** Interquartile range **HCP:** Healthcare professional

* p-value <0.05 was significant

! Infants should consume a daily 5 microgram vitamin D supplement from birth to 12 months of age (Food Safety Authority of Ireland, 2007)

¡ Women should consume a daily 400 microgram folic acid supplement from at least three months before conception to the twelfth week of pregnancy (*safe*food, 2015)

§ Association between normally distributed continuous data assessed by an Independent Samples *t*-test

ꓤ Association between non-normally distributed continuous data assessed using a Mann-Whitney *U* test

† Association between categorical variables assessed using the chi-squared test with Yates' Continuity Correction for 2x2 contingency tables

‡ Association between categorical variables assessed using the chi-squared test for 3x2 contingency tables

In univariate analyses, receiving supplementation advice from a health professional was the only significant predictor of correct vitamin D supplementation (**Table 5.8a**). However, in multivariate analyses (**Table 5.8b**), maternal education was also a significant predictor of correct supplementation at four months post-partum.

Table 5.8b Binary logistic regression model examining factors associated with recommended vitamin D supplementation amongst 158 4-month-old infants

Characteristic	β	*n*	OR	95% CI	*p*-value*
Maternal third level education					
Yes	-	103	0.37	0.15 – 0.92	**0.03**
No		55	1.0	Ref.	
Recommended folic acid supplementation					
Yes	+	51	1.56	0.67 – 3.64	0.30
No		107	1.00	Ref.	
Smoking in pregnancy					
Yes	+	51	1.00	Ref.	0.32
No		107	1.51	0.67 – 3.41	
Vitamin D advice from health professional					
Yes	+	127	61.94	11.53 – 332.83	**<0.01**
No		31	1.0	Ref.	
Maternal age	-	158	0.92	0.84 – 0.99	0.06

Model summary:
R^2 = 0.29, Cox & Snell R Square = 29.6, Nagelkerke R Square = 39.8, 74.7% predictive of variance

* *p*-value <0.05 was significant **OR:** Odds ratio **CI:** Confidence interval

As shown in the statistically significant adjusted model (χ^2 (5, *n*158) = 55.42, *p*<0.01) in **Table 5.8b**, the strongest predictor of correctly supplementing an infant with vitamin D at four months post-partum was having been advised to do so by a health professional. Mothers who received advice on vitamin D supplementation were almost 62 times (β = 4.126, OR: 61.94 [95% CI: 11.53-332.83]) more likely to correctly supplement their infant compared with mothers who did not receive supplementation advice (**Table 5.8b**). Maternal education was also a significant predictor of supplementation, where mothers who were third-level educated were significantly less likely to supplement their infant in line with recommendations (β = -0.986, OR: 0.37 [95% CI: 0.15-0.92]).

Significant predictors of correct vitamin D supplementation at nine months post-partum were also examined in univariate analyses (**Tables 5.9a**).

Table 5.9a Comparisons between mothers who did and did not supplement their 9-month-old infant with 5 micrograms of vitamin D daily

	Supplemented with vitamin D as recommended[!] (*n*54)		Did not supplement with vitamin D as recommended[!] (*n*104)		*p*-value*
	n	Mean ± SD	*n*	Mean ± SD	
Maternal age (years)	54	32.9 ± 4.4	104	31.6 ± 5.1	0.10§
Age of weaning (weeks)	54	21.1 ± 4.9	104	20.3 ± 4.4	0.13§
	n	Median (IQR)	*n*	Median (IQR)	
Duration of breastfeeding (days)	33	70.0 (14.0, 196.0)	65	70.0 (10.0, 175.0)	0.80ϰ
	n	%	*n*	%	
Maternal education					
Third level education	35	64.8	68	65.4	0.99†
No third level education	19	35.2	36	34.6	
Social class					
High	28	51.9	46	44.2	0.34‡
Middle	23	42.6	45	43.3	
Low	3	5.6	13	12.5	
Parity					
Nulliparous	24	44.4	44	42.3	0.93†
Multiparous	30	55.6	60	57.7	
Smoking status at conception					
Smoking	11	20.4	40	38.5	**0.03†**
Not smoking	43	79.6	64	61.5	
Smoked in all three trimesters	4	7.4	9	8.7	0.99†
Smoking at 9 months post-partum	5	9.3	17	16.3	0.34†
Consumed alcohol in pregnancy	10	18.5	25	24.0	0.56†
Correct folic acid supplementation[¡]	25	46.3	26	25.0	**0.01†**
First milk					
Breast milk	31	57.4	65	62.5	0.95†
Formula milk	23	42.6	39	37.5	
Vitamin D advice from a HCP					
Yes	52	96.3	75	72.1	**<0.01†**
No	2	3.7	29	27.9	

SD: Standard deviation **IQR:** Interquartile range **HCP:** Healthcare professional

* *p*-value <0.05 was significant

! Infants should consume a daily 5 microgram vitamin D supplement from birth to 12 months of age (Food Safety Authority of Ireland, 2007)

¡ Women should consume a daily 400 microgram folic acid supplement from at least three months before conception to the twelfth week of pregnancy (*safe*food, 2015)

§ Association between normally distributed continuous data assessed by an Independent Samples *t*-test

ϰ Association between non-normally distributed continuous data assessed using a Mann-Whitney *U* test

† Association between categorical variables assessed using the chi-squared test with Yates' Continuity Correction for 2x2 contingency tables

‡ Association between categorical variables assessed using the chi-squared test for 3x2 contingency tables

As shown in the statistically significant adjusted model (χ^2 (5, *n*158) = 28.48, $p<0.01$) in **Table 5.9b**, advice from a health professional and smoking in pregnancy made statistically significant contributions to the model which predicted correct vitamin D supplementation at nine months post-partum.

Table 5.9b Binary logistic regression model examining factors associated with recommended vitamin D supplementation amongst 158 9-month-old infants

Characteristic	β	*n*	OR	95% CI	*p*-value*
Maternal third level education					
Yes	-	103	0.67	0.31 – 1.46	0.32
No		55	1.0	Ref.	
Recommended folic acid supplementation					
Yes	+	51	2.06	0.95 – 4.45	0.07
No		107	1.00	Ref.	
Smoking in pregnancy					
Yes	+	51	1.00	Ref.	**0.02**
No		107	2.57	1.13 – 5.81	
Vitamin D advice from health professional					
Yes	+	127	10.30	2.29 – 46.27	**<0.01**
No		31	1.0	Ref.	
Maternal age	+	158	1.04	0.96 – 1.12	0.40

Model summary:
R^2 = 0.23, Cox & Snell R Square = 16.5, Nagelkerke R Square = 22.8, 71.5% predictive of variance

* *p*-value <0.05 was significant **OR:** Odds ratio **CI:** Confidence interval

The strongest predictor of correctly supplementing an infant with vitamin D at nine months post-partum was having been advised to do so by a health professional. Mothers who received advice on vitamin D supplementation were over ten times (β = 2.332, OR: 10.30 [95% CI: 2.29-46.27]) more likely to correctly supplement their infant when compared with mothers who did not receive supplementation advice (**Table 5.9b**). Smoking in pregnancy was also a significant predictor of vitamin D supplementation (**Table 5.9b**), where mothers who did not smoke antenatally were 2.5 times more likely to correctly supplement their infant (β = 0.942, OR: 2.57 [95% CI: 1.13-5.81]).

Significant predictors of correct vitamin D supplementation at 12 months post-partum were also examined. Although no factors appeared to be significant in univariate analyses (**Tables 5.10a**), multivariate analyses revealed two significant predictors (**Tables 5.10b**) of correct vitamin D supplementation practices.

Table 5.10a Comparisons between mothers who did and did not supplement their 12-month-old infant with 5 micrograms of vitamin D daily

	Supplemented with vitamin D as recommended[!] (n37)		Did not supplement with vitamin D as recommended[!] (n121)		p-value*
	n	Mean ± SD	n	Mean ± SD	
Maternal age (years)	37	32.6 ± 5.4	121	31.9 ± 4.8	0.10§
Age of weaning (weeks)	37	20.7 ± 5.0	121	20.6 ± 4.5	0.95§
	n	Median (IQR)	n	Median (IQR)	
Duration of breastfeeding (days)	19	70.0 (28.0, 196.0)	79	70.0 (7.0, 182.0)	0.73ϟ
	n	%	n	%	
Maternal education					
Third level education	20	54.1	83	68.6	0.15†
No third level education	17	45.9	38	31.4	
Social class					
High	11	29.7	63	52.1	
Middle	22	59.5	46	38.0	0.06‡
Low	4	10.8	12	9.9	
Parity					
Nulliparous	20	54.1	48	39.7	0.18†
Multiparous	17	45.9	73	60.3	
Smoking status at conception					
Smoking	8	21.6	43	35.5	0.17†
Not smoking	29	78.4	78	64.5	
Smoked in all three trimesters	3	8.1	10	8.3	0.99†
Smoking at 12 months post-partum	4	10.8	20	16.5	0.56†
Consumed alcohol in pregnancy	5	13.5	30	24.8	0.22†
Correct folic acid supplementation[¡]	14	37.8	37	30.6	0.53†
First milk					
Breast milk	18	48.6	78	64.5	0.13†
Formula milk	19	51.4	43	35.5	
Vitamin D advice from a HCP					
Yes	34	91.9	28	23.1	0.08†
No	3	8.1	93	76.9	

SD: Standard deviation **IQR:** Interquartile range **HCP:** Healthcare professional

* p-value <0.05 was significant

! Infants should consume a daily 5 microgram vitamin D supplement from birth to 12 months of age (Food Safety Authority of Ireland, 2007)

¡ Women should consume a daily 400 microgram folic acid supplement from at least three months before conception to the twelfth week of pregnancy (*safe*food, 2015)

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ϟ Association between non-normally distributed continuous data assessed using a Mann-Whitney U test

† Association between categorical variables assessed using the chi-squared test with Yates' Continuity Correction for 2x2 contingency tables

‡ Association between categorical variables assessed using the chi-squared test for 3x2 contingency tables

Table 5.10b Binary logistic regression model examining factors associated with recommended vitamin D supplementation amongst 158 12-month-old infants

Characteristic	β	*n*	OR	95% CI	*p*-value*
Maternal third level education					
Yes	-	103	0.42	0.19 – 0.95	**0.04**
No		55	1.0	Ref.	
Recommended folic acid supplementation					
Yes	+	51	1.21	0.53 – 2.80	0.65
No		107	1.00	Ref.	
Smoking in pregnancy					
Yes	+	51	1.00	Ref.	0.09
No		107	2.16	0.88 – 5.33	
Vitamin D advice from health professional					
Yes	+	127	3.85	1.05 – 14.08	**0.04**
No		31	1.0	Ref.	
Maternal age	+	158	1.03	0.94 – 1.12	0.56
Model summary: R^2 = 0.16, Cox & Snell R Square = 7.5, Nagelkerke R Square = 11.3, 77.8% predictive of variance					

* *p*-value <0.05 was significant **OR:** Odds ratio **CI:** Confidence interval

As shown in the statistically significant adjusted model (χ^2 (5, *n*158) = 12.34, *p*=0.03) in **Table 5.10b**, two of the five independent variables (advice from a health professional and maternal education) included made a statistically significant contribution to the model.

The strongest predictor of correctly supplementing an infant with vitamin D at 12 months post-partum was having been advised to do so by a health professional. Mothers who received advice on vitamin D supplementation in the early post-partum period were almost four times (β = 1.347, OR: 3.85 [95% CI: 1.05-14.08]) more likely to correctly supplement their 12-month-old infant compared with mothers who did not receive supplementation advice (**Table 5.10b**). Maternal education was also a significant predictor of supplementing an infant with vitamin D, where mothers who were third level-educated were significantly less likely to supplement their infant in line with recommendations (β = -0.858, OR: 0.42 [95% CI: 0.19-0.95]).

Overall, the advice of a health professional in the early post-partum period was the most consistent predictor of recommended vitamin D supplementation throughout the first year of life. Additionally, mothers with a college education and mothers who smoked during pregnancy were less likely to supplement their infant in line with recommendations.

5.5 Discussion

The short- and long- term importance of an infant's food environment throughout the first year of life has been well-established (Birch and Fisher, 2000; Birch and Davidson, 2001; Agostoni *et al.*, 2008; Butte, 2009; Lakshman *et al.*, 2015). This study found that while the positive trend of commencing weaning at an appropriate age continues, there are aspects of the weaning diet at age one year which need improvement, to include snack options, fluid choices and vitamin D supplementation practices.

5.5.1 Commencement of weaning

Complementary feeding refers to the introduction of food other than breast milk or formula milk into an infant's diet (Agostoni *et al.*, 2008). The most recent recommendations for weaning on to complementary foods in Ireland state that most infants should be introduced to such foods close to 26 weeks of age (FSAI, 2011). These recommendations acknowledge that some infants are developmentally ready for complementary foods before 26 weeks of age, but categorically state that no infant should be introduced to these foods before 17 weeks of age (FSAI, 2011).

The introduction of complementary foods before 17 weeks of age has previously been reported as a significant infant feeding issue amongst Irish mothers. For example, in 2008, Tarrant reported that in a sample of 401 Irish mothers, almost a quarter had introduced their infant to complementary foods at or before 12 weeks of age (Tarrant, 2008). Feeding practices have since improved, with recent representative studies reporting figures of 18.0% (O'Donovan *et al.*, 2015) and 15.5% (Dominguez Castro *et al.*, 2014) for starting weaning before 17 weeks of age, well below the European average of 25% (Schiess *et al.*, 2010). At 13.9%, the prevalence of early weaning in this study adds to the argument that the timing of weaning in Ireland continues to improve.

Early weaning has been associated with an increased risk of respiratory illness, eczema, asthma, coeliac disease, faltering growth, obesity, fussy eating, constipation and iron deficiency anaemia (Wilson *et al.*, 1998; Northstone *et al.*, 2001; Greer *et al.*, 2008; de Silva *et al.*, 2014). In light of the potential adverse consequences associated with early weaning, the improvement recorded in the timing of weaning over the past decade is a welcome development for public health strategy and the physical wellbeing of infants in Ireland.

5.5.2 Food and fluid intakes

Weaning on to solid food from a milk-only diet marks a substantial period of learning and discovery for an infant. Nutrition during this time is important, not only for optimal growth and neurodevelopment (Agostoni *et al.*, 2008; Conn *et al.*, 2009; Pearce and Langley-Evans, 2013), but also for the development of potentially lifelong food preferences and eating patterns (Northstone *et al.*, 2001; Nicklaus *et al.*, 2005; Maier *et al.*, 2008; Pearce and Langley-Evans, 2013; Walton *et al.*, 2014; Alvisi *et al.*, 2015).

At one year of age, the vast majority of infants in this study were consuming foods of an age-appropriate texture. It is recommended that at age one year, infants consume foods mainly of a minced and chopped consistency, in addition to consuming finger foods of a harder texture (FSAI, 2011). Since the delayed introduction of appropriately textured foods can result in later feeding difficulties (Mason *et al.*, 2005) and reduced food variety (Skinner *et al.*, 2002; Cooke *et al.*, 2004), particularly in terms of fruit and vegetable intake (Coulthard *et al.*, 2010), the well-timed introduction of suitably textured foods is a positive weaning practice (Coulthard *et al.*, 2009). For the small minority of infants who were not consuming advanced textures at one year of age, health professionals could use routine infant health checks to reiterate recommended feeding practices to parents, especially if infant feeding has not been discussed since the early stages of weaning (Allcutt and Sweeney, 2010; Tarrant *et al.*, 2010).

While it is encouraging to record positive practices in terms of the timing and progression of weaning, some suboptimal practices in terms of the snacks and fluids consumed were also recorded.

Infants are genetically predisposed to prefer high-energy foods characterised by sweet and salty tastes (Agostoni *et al.*, 2008; Alvisi *et al.*, 2015). If this predisposition for energy-dense palatable foods is indulged as weaning progresses, it may result in unbalanced dietary intakes from the early stages of feeding (Agostoni *et al.*, 2008; Hetherington *et al.*, 2011). In this study, two-thirds of infants aged one year consumed biscuits as a snack more than once a week and over a quarter consumed chocolate and ice-cream as a snack more than once a week. Since eating patterns established in infancy set the precedent for eating habits in toddlerhood and childhood, it is important that caregivers prioritise the provision of foods which are without added sugar and salt at this time (Agostoni *et al.*, 2008; FSAI, 2011; Alvisi *et al.*, 2015).

It is also important that such foods are accompanied by appropriate and unsweetened fluids where possible (FSAI, 2011). In this study, and reflecting the figure reported by the National Preschool Nutrition Survey (NPNS) (IUNA, 2012), a third of infants were consuming non-milk beverages such as fruit juice and dilute fruit drinks on a daily basis. Throughout the weaning process, milk and water should be the fluids of choice, as they benefit physical and dental health (FSAI, 2011). Fluids such as juices are particularly cariogenic, especially if recommended oral hygiene practices are not in place (FSAI, 2011). Such fluids can also reinforce an infant's preference for sweet tastes, and can therefore make it more difficult to establish healthy dietary habits as an infant moves into toddlerhood.

The provision of a no added sugar and salt weaning diet which includes appropriate fluid types and volumes, may reduce an infant's preference for sweet and salty tastes (Agostoni *et al.*, 2008; FSAI, 2011; Ventura and Worobey, 2013; Alvisi *et* *al.*, 2015). Such a diet can promote healthier weight gain, dental health and dietary variety in infancy, and these short-term health benefits naturally feed into better physical health and more healthful food preferences over the longer term (Agostoni *et al.*, 2008; Ventura and Worobey, 2013). Explicit guidance for parents on the latter stages of weaning an infant is often more limited (Hetherington *et al.*, 2011). However, since parents shape their infant's food intake far beyond the first year of life (Blissett, 2011), it is important that public health strategies developed by the Health Service Executive (HSE), Food Safety Authority of Ireland (FSAI), *safe*food and other relevant stakeholders, make clear to parents what feeding skills and dietary habits an infant should ideally have as they move into toddlerhood.

5.5.3 Maternal infant feeding style

In addition to examining the particular foods consumed by infants in this study, the manner in which infants were fed by their mothers was also explored. Maternal infant feeding style refers to the behavioural strategies employed by mothers to influence their infant's food intake (Gregory *et al.*, 2010). The components of a *controlling* feeding style were examined in this study, *i.e.* pressure to eat, restriction and monitoring. *Controlling* feeding practices are also referred to as *non-responsive* feeding practices, because they fail to recognise, and appropriately respond to, an infant's internal cues of hunger (McPhie *et al.*, 2014). As such, it is thought that these practices ultimately disrupt an infant's ability to self-regulate their own food intake, potentially increasing the risk of undesirable weight gain (DiSantis *et al.*, 2011).

In addition to creating the emotional and social environment in which food is consumed (McPhie *et al.*, 2014), a mother is the person most often responsible for establishing the quality, quantity and timing of food available to an infant (Harrison *et al.*, 2011). In light of this extensive influence over feeding, it is important to establish the factors which affect how a mother chooses to feed her infant. In this study, however, despite collecting data on a host of maternal characteristics, and despite using a validated instrument to examine maternal feeding style (Birch *et al.*, 2001; Brown and Lee, 2011), only a small number of relatively weak associations between maternal characteristics and their resulting infant feeding style were elucidated.

A recent systematic review stated that the factors which determine a mother's infant feeding style are complex and varied (McPhie *et al.*, 2014). Although research has been conducted to explore the outcomes of maternal infant feeding style, most of this research has focused on outcomes in older children, particularly in terms of the attitudes of children towards foods which their mothers restrict or encourage (Birch and Fisher, 2000; Birch and Davidson, 2001). Such attitudes, naturally, cannot be measured amongst infants. In addition to being somewhat limited, the research in this area has been inconsistent, with controlling feeding styles being associated with increased food intake and weight (Fisher and Birch, 1999; Campbell *et al.*, 2006), decreased food intake and weight (Fisher *et al.*, 2002; Galloway *et al.*, 2005; Galloway *et al.*, 2006; Crouch *et al.*, 2007) and with having no effect on food intake and weight (Spruijt-Metz *et al.*, 2002; Kröller and Warschburger, 2008; Musher-Eizenman *et al.*, 2009).

It is clear that questions remain over how maternal infant feeding style shapes an infant's early food environment. Without an understanding of what influences the development of eating habits in infancy, it is difficult to understand the food choices and habits of toddlers and young children (Farrow and Blissett, 2008). Therefore, there is a need for longitudinal research which not only investigates associations between infant outcomes and maternal infant feeding style, but also explores maternal personal characteristics, parenting style and psychopathology (McPhie *et al.*, 2014). This broader view of feeding may lend itself to a better understanding of how maternal infant feeding style develops. In turn, this understanding may shed light on how to positively influence the development of maternal infant feeding style and the infant feeding environment.

5.5.4 Nutrient intakes and vitamin D supplementation at 12 months of age

In addition to investigating the types of foods and fluids consumed at 12 months of age, this study also determined the nutritional content of the foods and fluids consumed. The nutritional intakes of infants were comparable to those reported in the nationally representative NPNS (IUNA, 2012), most particularly the intakes of kilocalories, protein, carbohydrate, total fat and calcium. Of particular interest were the vitamin D intakes in this study; although vitamin D intakes were higher than those reported in the NPNS (IUNA, 2012), they still fell short of recommended intakes (Institute of Medicine [IOM], 2010), even when vitamin D intakes by way of supplementation were included.

The chief functions of vitamin D are the regulation of calcium homeostasis and bone mineral metabolism (IOM, 2010; Gallo *et al.*, 2016). Over the lifespan, the most accelerated rates of growth and bone mineral accretion occur in infancy (Gallo *et al.*, 2012; Gallo *et al.*, 2016), with evidence indicating that maximising bone accretion during this time benefits bone health at later stages of the life cycle (Cooper *et al.*, 2002; Gallo *et al.*, 2012; Holroyd *et al.*, 2012).

Naturally, vitamin D deficiency adversely affects bone health, with chronic deficiency resulting in bone demineralisation. If the deficiency is particularly severe, the resulting demineralisation can reduce bone rigidity, causing rickets, a condition which manifests in infancy as deformed arms, legs and rib cage. Rickets is the most severe and chronic manifestation of vitamin D deficiency in infancy, and although a small number of cases have emerged in recent years, it remains an uncommon condition (FSAI, 2007). However, mild but chronic vitamin D deficiency may be a more widespread issue due to inadequate dietary vitamin D intakes and the practice of not exposing infants to sunlight (FSAI, 2007; IUNA, 2012).

To address vitamin D deficiency and enhance bone health, it is recommended that all infants consume five micrograms of vitamin D by supplementation each day from birth to their first birthday. This recommendation was first made by the FSAI in 2007 and adopted by the HSE in 2010. Despite the comprehensive strategy put in place (HSE, 2010) and the widespread promotion of vitamin D supplementation in infancy by the FSAI and HSE, vitamin D supplementation practices in this study were suboptimal throughout the first year of life. With less than a quarter of infants being correctly supplemented at age one year, and with a mean daily intake of vitamin D, even including supplementation, falling below the recommended intake of ten micrograms (IOM, 2010), it is important that this aspect of paediatric health continues to receive attention.

The identification of strategies which effectively encourage adherence to national supplementation policies is often a challenging element of public health promotion (McKeating *et al.*, 2015; Cawley *et al.*, 2016). It is notable that the advice of health professionals was the most consistent and significant predictor of recommended vitamin D supplementation practices in this study, surpassing many sociodemographic characteristics and health behaviours. Mothers who received supplementation advice from a health professional in the weeks following their infant's birth were significantly more likely to correctly supplement their infant for the remainder of the first year of life. The strength of the association waned as the first year of life progressed; however, better adherence to recommendations may result if health professionals remain conscious of advocating supplementation and foods rich in vitamin D during routine health checks and vaccinations.

Additionally, since approximately half of the maternal stores of vitamin D are transferred to the foetus during pregnancy (Cooper *et al.*, 2002), it is important that health professionals advise pregnant women on appropriate vitamin D-rich foods and safe vitamin D supplementation (Christesen *et al.*, 2012; Bener *et al.*, 2013). Persistent reminders on the importance of adequate vitamin D intakes from diet and supplementation, in pregnancy and throughout the first year of life, are an important part of safeguarding the bone health of mother and infant (Patience, 2015).

5.5.5 Strengths and limitations of this study

The data presented here were collected as part of a longitudinal observational study conducted by one researcher in Dublin and its surrounding counties. Before drawing final conclusions on this study, its strengths and limitations must be considered.

In terms of limitations, firstly, the results are not nationally representative and the study population was limited to participants who were Caucasian and of Irish or British nationality.

Secondly, causal inferences cannot be made due to the observational study design (Grimes and Schulz, 2002). Food intake amongst 12-month-old infants was measured using estimated household measures. Weighed measures would be considered preferable (Burrows *et al.*, 2010; Smith, 2011) to assess food intake in infants, but this was not feasible when study resources and participant burden were considered. Nevertheless, the food diaries used did obtain detailed data on the foods consumed, to include food brands and packet sizes, and measuring spoons were also provided to help mothers to complete the diary. The foods and food volumes consumed were inputted into the nutrient analysis software *Nutritics* (Dublin, Ireland), which provided up-to-date nutrition composition data on the foods inputted. Furthermore, although estimated household measures were used, the nutrient intakes in this study are comparable to those reported by the nationally representative NPNS, in which weighed measures were used to assess food intakes (IUNA, 2012).

Other strengths of the study include the lack of inter-observer variation, consistent application of World Health Organisation (2004) definitions to reported milk feeding practices and the use of a validated tool to measure maternal infant feeding style (Birch *et al.*, 2001; Brown and Lee, 2011).

5.6 Contribution to the literature

To the author’s knowledge, this is one of the first studies to investigate vitamin D supplementation practices since the adoption of the national recommendations on vitamin D supplementation in infancy (FSAI, 2007) by the HSE in 2010. The study provided valuable insights into compliance with the policy and into the factors affecting its implementation. The study also indicated that positive trends in the timing and progression of weaning continue, but that further research into the factors affecting the development of an infant’s food environment is needed, to include closer examination of maternal infant feeding style and its role in infant outcomes.

5.7 Conclusion

The food environment in infancy is important not only for meeting the nutritional needs of infants, but also for establishing food intake patterns and eating behaviours which potentially set the tone for lifelong eating habits. A substantial amount of research has investigated the nutritional content, and progression of, the weaning diet. Furthermore, the introduction of recommended supplementation practices throughout the first year of life has added another dimension to nutritional intakes in infancy which must be monitored. However, questions remain over how the behaviours of food providers underpin the development of an infant’s behaviours towards food. With a better understanding of these two key aspects of infant feeding – nutrition and socialisation – a clearer sense of how to positively influence infant food intakes and behaviours during this time of inestimable investment into future health can be obtained.

5.8 References

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6.1 Introduction

6.1.1 Existing literature

This thesis outlined sociodemographic characteristics and health behaviours in **chapter three** and explored several aspects of infant feeding in **chapters four** and **five**. This chapter will progress to examining growth, and will investigate the associations, if any, between the findings outlined in **chapters three**, **four** and **five** with the measures of infant growth and body composition obtained in the study.

Following the publication of the World Health Organisation (WHO) growth standard in 2006 (World Health Organisation [WHO] Multicentre Growth Reference Study Group, 2006), it was recommended that the United Kingdom (UK) adopt the WHO growth standard from the age of two weeks, but retain the British 1990 (UK90) data for 23-42 weeks gestation (Scientific Advisory Committee on Nutrition [SACN] and Royal College of Paediatrics and Child Health [RCPCH] Expert Group, 2007). Therefore, in the resulting UK-WHO growth charts (RCPCH, 2013a; RCPCH, 2013b), UK90 birth data depict weight gain in the first two weeks of life and WHO growth data are used from two weeks of age onwards. The new charts are more accurate than those used previously (Freeman *et al.*, 1995; Cole *et al.*, 2011), and since they are based on the growth of healthy breastfed children living in optimal circumstances, they provide a standard for how all children *should* grow (Cole *et al.*, 2012; Wright *et al.*, 2012).

Regular use of such charts is an essential element of assessing healthy growth (Cole *et al.*, 2011). Elevated or rapid weight gain is indicated by upward centile crossing on a growth chart of two or more adjacent centile lines (Ong *et al.*, 2000). In a systematic review published by Baird *et al.* (2005), infants who underwent rapid weight gain were up to six times more likely to become obese children when compared with infants who did not have rapid weight gain. Since the publication of this review, observational studies continue to report associations between the pattern of weight gain in infancy and the development of overweight in childhood and even adulthood (Barker *et al.*, 2005; Stettler *et al.*, 2005; Ekelund *et al.*, 2007; Ylihärsilä *et al.*, 2008). The pattern of weight gain in infancy has also been associated with the development of chronic diseases such as cardiovascular disease (CVD) (Eriksson, 2005; Barker, 2007; Singhal *et al.*, 2007) and Type II diabetes mellitus (T2DM) (Eriksson *et al.*, 2003; Eriksson *et al.*, 2006; Norris *et al.*, 2012). In light of the potential consequences of rapid growth, a substantial amount of research has been conducted on identifying factors which increase the likelihood of a favourable growth pattern in infancy.

In addition to infant growth patterns, there has been increasing interest in understanding the implications of infant body composition on future health outcomes. Normative values for body composition at birth have been published in an Irish population (Hawkes *et al.*, 2011), but the implications of percentage body fat at birth on later body composition, weight or metabolic risk remain to be elucidated.

6.1.2 Knowledge gaps

The identification of factors which consistently and adversely affect infant growth has proved challenging (Dattilo *et al.*, 2012), and this is partly due to differences in the definition of undesirable growth in infancy (Ong and Loos, 2006) and differences in study designs and outcomes (Monteiro and Victoria, 2005). That said, the Growing Up in Ireland study has provided important insights into factors underlying undesirable growth amongst infants in Ireland (Layte and McCrory, 2014), and Hawkes *et al.* (2011) have provided normative values on body composition at birth for a large Irish cohort of infants.

Therefore, although a considerable body of work has been published on infant growth patterns in Ireland, investigation into body composition in infancy is still in its early stages. As such, alongside assessing the growth patterns of a sample of Irish infants throughout the first year of life, this study will investigate measures of infant body composition at birth and will also explore the factors associated with body composition at 12 months of age.

6.2 Aims and objectives

The overall aim of this study was to gain some insight into the rapidity and quality of growth amongst healthy term infants during the first year of life. The specific objectives devised to achieve this aim were to assess the:

- Anthropometric measurements of infants at birth and at four, nine and 12 months of age;
- Association between maternal sociodemographic and health behavioural characteristics and infant growth;
- Associations between infant characteristics and growth;
- Factors associated with percentage body fat at birth and at 12 months of age; and
- Usability of devices designed for the measurement of infant body composition at birth and at 12 months of age.

6.3 Methodology

This analysis focused on data from 158 mother-infant dyads on whom data were obtained at five points, *i.e.* pregnancy, birth, and four, nine and 12 months post-partum. The study design, development of questionnaires and recruitment and follow-up of study participants are described in more detail in **chapter two**, **sections 2.6 to 2.10**.

6.3.1 Measurement of infant physical growth

The methodologies employed to measure infant growth at birth and at four, nine and 12 months of age are outlined in detail in **chapter two**, **sections 2.7.3, 2.8.3, 2.9.3** and **2.10.3**, respectively.

UK-WHO gender-specific growth charts (RCPCH, 2013a; RCPCH, 2013b) were used to plot weight, length and head circumference at each time point. In addition to weight, length and head circumference, each infant's chest circumference, abdominal circumference, mid-arm circumference and mid-thigh circumference were also measured and documented.

6.3.2 Measurement of infant body composition

At birth, a PEA POD air displacement plethysmography system (COSMED, Surrey, UK) was used to assess body composition (fat and fat-free mass). Body composition was measured in line with the manufacturer's instructions, as explained in **chapter two**, **section 2.7.3**.

At 12 months of age, the ImpediMed SFB7 (ImpediMed Ltd., Pinkenba, Queensland, Australia) was used to assess body composition (fat and fat-free mass). This device uses bioimpedance spectroscopy (BIS) to assess body composition, and its use is described in **chapter two**, **section 2.10.3**.

6.3.3 Questionnaire items

Maternal body mass index (BMI), folic acid supplementation and sociodemographic characteristics (*i.e.* education level, marital status, health insurance status, planned pregnancy and parity) were recorded in pregnancy (Appendix 4). Maternal smoking status and alcohol consumption were recorded in pregnancy (Appendix 4) and at four, nine and 12 months post-partum (Appendices 11, 14 and 17, respectively). Infant feeding characteristics were recorded at birth (Appendix 7) and at four, nine and 12 months of age (Appendices 11, 14 and 17, respectively).

6.3.4 Definitions

Social class: Maternal occupations were initially categorised into seven social class categories (Central Statistics Office [CSO], 1996). Due to the small sample size available for analysis in this chapter, the initial seven categories of social class were collapsed into three categories (Carling *et al.*, 2015), as follows.

- Professional, managerial and technical workers were grouped together to form a *high social class*
- Non-manual, skilled manual, semi-skilled and unskilled groups, students and stay-at-home mothers were grouped together to form a *middle social class*
- Unemployed persons and those whose occupation was unknown were grouped together to form a *low social class*

Material deprivation: Material deprivation was categorised according to the deprivation index (CSO, 2010). Mothers who were denied ≥2 items from the deprivation index due to lack of income were deemed materially deprived.

Body Mass Index: Since no mother was underweight and the sample size was small, BMI was categorised as healthy (18.5–24.9kg/m^2) or overweight (>25.0kg/m^2) (WHO, 2015).

Size for gestational age: Birth weight was recorded as small (≤2500 grams), appropriate (2500 – 4000 grams) or large (≥4000 grams) for gestational age (Rumack *et al.*, 2011).

Ponderal index: Ponderal index is a weight-for-length (WFL) ratio, and was calculated as follows: (mass*100) / length^3, where mass was measured in grams and length was measured in centimetres (Oluwafemi *et al.*, 2013).

Rapid growth: Rapid growth was defined as a variation greater than 0.67 in WFL *z*-scores between two measurements (Ong *et al.*, 2000). WFL gain has a greater effect on obesity than weight gain alone (Taveras *et al.*, 2009).

6.3.5 Statistical analysis

Data analyses were performed using SPSS for Windows, version 22.0 (IBM, New York, United States). Statistical significance was taken at p<0.05.

Descriptive analysis

The distribution of the data was assessed using the Shapiro-Wilk test of normality, where a non-significant *p*-value (*i.e.* >0.05) indicated normality. Normally distributed continuous data were summarised numerically using the mean ± standard deviation (SD), and two normally distributed means were compared using the Independent Samples *t*-test. Non-normally distributed continuous data were summarised numerically using the median and interquartile range (IQR), and two non-normally distributed means were compared using the Mann-Whitney *U* test. To compare differences in the mean scores of a dependent variable across three groups, a one-way between-groups analysis of variance (ANOVA) was conducted. Post-hoc comparisons were made using the Tukey HSD test (Field, 2013).

Bivariate correlations were performed to assess the direction of a relationship between two variables. The Pearson correlation coefficient assessed the strength of the relationship between normally distributed variables and the Spearman correlation coefficient assessed the relationship between non-normally distributed variables.

Univariate and multivariate analyses

Associations between categorical variables were assessed by cross-tabulations, and the Chi-squared statistics test assessed statistical significance. Yates' Continuity Correction was used for 2x2 contingency tables to improve the Chi-square approximation.

To explore factors which were associated with rapid weight gain, independent variables which were significant (p<0.05) in univariate analyses were included multivariate analyses (Pallant, 2010). Maternal age, education level and smoking status were also included, regardless of significance level, due to the precedence in the literature for their influence on this growth (Griffiths *et al.*, 2010; Carling *et al.*, 2015).

Prior to performing regression, Tabachnick and Fidell's (2007) formula was used to ensure that an acceptable number of independent variables were entered into the model. The sample size should meet or exceed 50 + 8m, where *m* is the number of independent variables included in the model. The sample size available to predict rapid weight gain between birth and 12 months of age was adequate for the number of variables entered into the model.

Multicollinearity was also assessed by conducting correlations between independent variables to ensure that the Pearson correlation coefficient was <0.9. If two variables were highly correlated (*i.e.* Pearson correlation coefficient was >0.9), the most appropriate variable was included in the model and the other variable was excluded.

Binary logistic regression was then performed using the Forced Entry Method (Pallant, 2010). To predict rapid weight gain between birth and 12 months of age, the dependent variable was based on the WFL *z*-score, where a score >0.67 indicated rapid weight gain. Therefore, the codes for the dependent variable in analysis were: *1 = rapid weight gain* and *0 = no rapid weight gain*.

The usefulness of the model was then assessed (Pallant, 2010). The Hosmer-Lemeshow Goodness of Fit Test was checked to ensure that p>0.05, to indicate support for the model. The Cox & Snell R Square and the Nagelkerke R Square values (where values greater than 20.0 were acceptable) provided an indication of the amount of variation in the dependent variable which was explained by the model (Pallant, 2010). The significance value produced by the Wald test for each independent variable in the model was also checked. Variables with a significance value of <0.05 contributed significantly to the predictive ability of the model, and therefore significantly predicted the dependent variable, *i.e.* rapid weight gain.

The Exp (B) value, or odds ratio (OR), and the 95% confidence interval (CI) were recorded for each independent variable. Finally, the ZResid values were assessed to identify outliers and therefore to ensure that no cases with a ZResid value greater than 2.5 or less than -2.5 had been included in analysis.

6.4 Results

6.4.1 Maternal and infant characteristics

The sociodemographic and health behavioural characteristics of women recruited in pregnancy and followed-up until their infant was one year old are outlined in **Table 6.1**. Almost three-quarters (73.4%, *n*116) of these women planned their pregnancy. Almost all (99.4%, *n*157) supplemented with some folic acid, but less than a third (32.3%, *n*51) supplemented with folic acid in line with recommendations (*safe*food, 2015).

Table 6.1 Sociodemographic characteristics and health-related behaviours of 158 women in pregnancy and throughout the first year post-partum

		n	%
Highest education level	Second-level education	38	24.1
	Vocational qualification	17	10.8
	Third level degree	103	65.2
Maternal material deprivation	Experiencing material deprivation	40	25.3
	Not experiencing material deprivation	118	74.7
Parity	Nulliparous	68	43.0
	Multiparous	90	57.0
Pre-pregnancy BMI	Underweight	2	1.3
	Healthy weight	77	48.7
	Overweight	62	39.2
	Obese	17	10.8
Gestational diabetes	Yes	4	2.5
	No	154	97.5
Smoker	At conception	51	32.3
	All throughout pregnancy	13	8.2
	4 months post-partum	19	12.0
	9 months post-partum	22	13.9
	12 months post-partum	24	15.2
Consumed any alcohol	In pregnancy	35	22.2
	4 months post-partum	131	82.9
	9 months post-partum	138	87.3
	12 months post-partum	136	86.1

BMI: Body Mass Index

Among smokers, the mean number of cigarettes smoked per day in pregnancy was nine cigarettes. At four, nine and 12 months post-partum, a mean of nine, nine and ten cigarettes were smoked per day, respectively. Amongst those who consumed alcohol in pregnancy (22.2%, *n*35), the average number of units consumed per drinking occasion were 2.6 units. At four, nine and 12 months post-partum, an average of 4.4, 4.6 and 4.5 units of alcohol were consumed per drinking occasion, respectively.

The mean age of mothers upon giving birth was 32.0 (SD ± 4.9) years, and the mean gestational age of infants born to these mothers was 40.3 (SD ± 1.2) weeks. Characteristics important for the assessment of infant growth are shown in **Table 6.2**.

Table 6.2 Birth-related and infant feeding characteristics of a sample of 158 mothers and infants

		n	%
Mode of delivery	Vaginal delivery	120	75.9
	Caesarean section	38	24.1
Infant gender	Male	68	43
	Female	90	57
Birth weight category	Small for gestational age	1	0.6
	Appropriate for gestational age	132	83.5
	Large for gestational age	25	15.8
First milk	Breast milk	103*	65.2
	Formula milk	55	34.8
Receiving any breast milk	Before hospital discharge	105*	66.5
	At hospital discharge	83	52.5
	At 4 months of age	39	24.7
	At 9 months of age	22	13.9
	At 12 months of age	20	12.7
Appropriateness of weaning†	Early (<17 weeks)	22	13.9
	Appropriate (17-26 weeks)	130	82.3
	Late (>26 weeks)	6	3.8
Allergy	Yes	5	3.2
	No	153	96.8
In non-parental childcare	Yes	98	62.0
	No	60	38.0

≤: Less than or equal to **≥:** Greater than or equal to **<:** Less than **>:** Greater than

* Due to a medical emergency following labour, two mothers were unable to breastfeed their infant for the first feed; formula milk was provided instead. However, each infant later received breast milk upon the recovery of their mother, resulting in 66.5% (*n*105) of infants in this sample receiving breast milk on at least one occasion

† Appropriate weaning age: infants should commence weaning on to solid food not before 17 weeks of age and not later than 26 weeks of age (Food Safety Authority of Ireland, 2011)

The average hospital stay was 54.6 (SD ± 31.7) hours. Two-thirds (66.5%, *n*105) of the mothers in this sample breastfed their infant on at least one occasion (**Table 6.2**), but by discharge the rate of exclusive breastfeeding had decreased to 38.0% (*n*60). A further 14.6% (*n*23) were partially breastfeeding, and almost half (47.5%, *n*75) were exclusively formula feeding at hospital discharge. The median duration of any breastfeeding was 7.0 (2.0, 26.0) weeks, and of those mothers who initiated breastfeeding (*n*105), almost a quarter (23.8%, *n*25) exclusively breastfed for 26 weeks.

The average age at which weaning commenced was 20.7 (SD ± 4.6) weeks, with 82.3% (*n*130) of infants being weaned at an appropriate age (**Table 6.2**).

At 12 months of age, 62.0% (*n*98) of infants were in non-parental childcare. Almost half (45.9%, *n*45) were attending non-parental childcare on a part-time basis and 54.1% (*n*45) were attending full-time childcare. The majority (58.2%, *n*57) of mothers with an infant in childcare provided their infant's meals and snacks.

6.4.2 Measurements of infant growth

The mean age of infants at measurement in hospital was 29.9 (SD ± 15.8) hours. Infants were measured, on average, within 3.3, 6.5 and 8.8 days of turning four, nine and 12 months of age, respectively. The physical measurements taken are shown in **Table 6.3a**.

Table 6.3a Mean anthropometric measurements of 158 infants throughout the first year of life

	Birth	4 months old	9 months old	12 months old
Head circumference (cm ± SD)	35.1 ± 1.2	42.0 ± 1.1	45.8 ± 1.2	46.9 ± 1.2
Chest circumference (cm ± SD)	33.5 ± 1.7	42.3 ± 2.1	46.2 ± 2.1	47.8 ± 2.2
Abdominal circumference (cm ± SD)	32.7 ± 1.9	41.7 ± 3.0	44.6 ± 2.7	45.7 ± 3.1
Mid-arm circumference (cm ± SD)	10.9 ± 0.9	13.9 ± 1.1	15.4 ± 1.2	15.7 ± 1.2
Mid-thigh circumference (cm ± SD)	14.6 ± 1.4	21.7 ± 1.9	25.0 ± 2.2	25.7 ± 2.8
Length (cm ± SD)	51.2 ± 2.0	65.0 ± 2.3	73.0 ± 2.4	76.9 ± 2.6
Weight (kg ± SD)	3.55 ± 0.43	6.87 ± 0.75	9.03 ± 1.23	10.04 ± 1.09
Ponderal Index*	2.64 ± 0.22	2.50 ± 0.23	2.32 ± 0.27	2.21 ± 0.18

cm: Centimetres **SD:** Standard deviation **kg:** Kilograms

* Calculated as [weight (grams) * 100 / length^3 (centimetres)]

The gender differences in the anthropometric measurements taken throughout the first year of life are shown overleaf in **Table 6.3b**.

Table 6.3b Gender differences in anthropometric measurements taken on 158 infants in the first year of life

	Male *n*68	Female *n*90	*p*-value*†
Birth			
Gestational age (weeks ± SD)	40.2 ± 1.3	40.3 ± 1.2	0.93
Head circumference (cm ± SD)	35.2 ± 1.2	34.9 ± 1.1	0.09
Chest circumference (cm ± SD)	33.5 ± 1.6	33.5 ± 1.8	0.85
Abdominal circumference (cm ± SD)	32.7 ± 1.8	32.7 ± 2.0	0.96
Mid-arm circumference (cm ± SD)	10.9 ± 0.8	10.8 ± 1.0	0.63
Mid-thigh circumference (cm ± SD)	14.8 ± 1.3	14.5 ± 1.4	0.25
Length (cm ± SD)	51.9 ± 2.0	50.6 ± 1.8	**<0.01**
Weight (g ± SD)	3614.9 ± 448.0	3493.0 ± 419.0	0.08
Ponderal index	2.58 ± 0.21	2.68 ± 0.21	**<0.01**
4 months of age			
Head circumference (cm ± SD)	42.4 ± 1.0	41.7 ± 1.0	**<0.01**
Chest circumference (cm ± SD)	42.9 ± 2.3	41.9 ± 1.9	**<0.01**
Abdominal circumference (cm ± SD)	42.1 ± 2.9	41.5 ± 3.1	0.22
Mid-arm circumference (cm ± SD)	14.2 ± 1.1	13.8 ± 1.0	**0.02**
Mid-thigh circumference (cm ± SD)	22.0 ± 1.9	21.5 ± 1.9	0.06
Length (cm ± SD)	66.1 ± 2.1	64.2 ± 2.0	**<0.01**
Weight (g ± SD)	7197.9 ± 707.7	6625.4 ± 679.6	**<0.01**
Ponderal index	2.49 ± 0.22	2.50 ± 0.24	0.79
9 months of age			
Head circumference (cm ± SD)	46.2 ± 1.1	45.4 ± 1.2	**<0.01**
Chest circumference (cm ± SD)	47.0 ± 2.0	45.5 ± 2.0	**<0.01**
Abdominal circumference (cm ± SD)	45.5 ± 2.3	43.8 ± 2.7	**<0.01**
Mid-arm circumference (cm ± SD)	15.7 ± 1.1	15.1 ± 1.1	**<0.01**
Mid-thigh circumference (cm ± SD)	25.5 ± 2.0	24.6 ± 2.3	**<0.01**
Length (cm ± SD)	74.4 ± 2.1	72.0 ± 2.1	**<0.01**
Weight (g ± SD)	9592.1 ± 874.0	8614.0 ± 1303.4	**<0.01**
Ponderal index	2.33 ± 0.19	2.30 ± 0.32	0.49
12 months of age			
Head circumference (cm ± SD)	47.4 ± 1.1	46.6 ± 1.2	**<0.01**
Chest circumference (cm ± SD)	48.8 ± 2.1	47.1 ± 2.0	**<0.01**
Abdominal circumference (cm ± SD)	46.6 ± 3.0	45.0 ± 2.9	**<0.01**
Mid-arm circumference (cm ± SD)	16.0 ± 1.3	15.5 ± 1.1	**0.01**
Mid-thigh circumference (cm ± SD)	26.3 ± 2.1	25.3 ± 3.2	**0.03**
Length (cm ± SD)	78.2 ± 2.3	75.8 ± 2.2	**<0.01**
Weight (g ± SD)	10515.4 ± 999.8	9679.0 ± 1024.2	**<0.01**
Ponderal index	2.20 ± 0.19	2.21 ± 0.18	0.44

cm: Centimetres **g:** Grams **SD:** Standard deviation * *p*-value of <0.05 was significant

† Association between normally distributed continuous data assessed using an Independent Samples *t*-test

As shown in **Table 6.3b**, males were significantly longer than females at birth, but not significantly heavier, and therefore had a significantly lower ponderal index. At four, nine and 12 months of age, males were significantly longer and heavier than females, and so ponderal index was not significantly different (**Table 6.3b**).

6.4.3 Proportion of infants experiencing rapid weight gain

WFL *z*-score was used to categorise infants according to rate of weight gain. A change in WFL *z*-score of >0.67 SD indicated rapid weight gain and a change of ≤0.67 SD indicated non-rapid weight gain (Ong *et al.*, 2000). Over a quarter (28.5%, *n*45) of the infants in this study experienced rapid weight gain between birth and 12 months of age (**Table 6.4**).

Table 6.4 Proportions of infants experiencing a change in weight-for-length z-score between 4 separate intervals in the first year of life

	Rapid weight gain†		Non-rapid weight gain‡	
	n	%	*n*	%
Between birth and 4 months of age	47	29.7	111	70.3
Between 4 months and 9 months of age	28	17.7	130	82.3
Between 9 months and 12 months of age	26	16.5	132	83.5
Between birth and 12 months of age	45	28.5	113	71.5

† Indicated by a change in weight-for-length *z*-score of >0.67 standard deviations (SD) between the ages specified
‡ Indicated by a change in weight-for-length *z*-score of ≤0.67 SD between the ages specified

6.4.4 Factors associated with rapid and non-rapid growth in infancy

Factors associated with rapid weight gain between birth and 12 months of age were first examined using univariate analyses, as shown in **Table 6.5**. Although not shown, maternal deprivation, health insurance, medical card status and type of delivery, and infant allergies, day care attendance and sleep patterns, were not significantly associated with rapid weight gain in the first year of life.

Factors associated with rapid weight gain between birth and four months of age, between four and nine months of age and between nine and 12 months of age were also examined (data not shown). No sociodemographic or health behavioural characteristics were found to be significantly associated with rapid weight gain between these ages.

Table 6.5 Comparison between the characteristics of infants experiencing rapid weight gain and stable weight gain between birth and 12 months of age

Characteristic	Rapid weight gain (n45)		Non-rapid weight gain (n113)		p-value*
	n	Mean ± SD	n	Mean ± SD	
Infant birth weight (grams ± SD)	45	3353.3 ± 424.9	113	3622.0 ± 415.9	**<0.01ϰ**
Fat mass at birth (grams ± SD)[!]	44	335.9 ± 137.0	101	375.7 ± 160.2	0.15ϰ
Fat-free mass at birth (grams ± SD)[!]	44	2903.0 ± 331.8	101	3076.3 ± 339.1	**<0.01ϰ**
	n	Median (IQR)	n	Median (IQR)	
Duration of breastfeeding (days)	30	70.0 (18.3, 189.0)	68	70.0 (14.0, 182.0)	0.84§
	n	%	n	%	
Maternal education					
Third-level education	25	55.6	78	69.0	0.16‡
No third-level education	20	44.4	35	31.0	
Maternal social class					
High	20	44.4	54	47.8	
Middle	20	44.4	48	42.5	0.92†
Low	5	11.2	11	9.7	
Parity					
Nulliparous	25	55.6	43	38.1	0.07‡
Multiparous	20	44.4	70	61.9	
Maternal body mass index					
≤24.9kg/m^2	23	51.1	56	49.6	0.99‡
≥25.0kg/m^2	22	48.9	57	50.4	
Had gestational diabetes mellitus	2	4.4	2	1.8	0.69‡
Smoked in all three trimesters	2	4.4	11	9.7	0.44‡
Consumed alcohol during pregnancy	3	6.7	32	28.3	**<0.01‡**
Maternal age at delivery					
≤24 years	5	11.1	8	7.1	
25-35 years	26	57.8	78	69.0	0.39†
≥36 years	14	31.1	27	23.9	
Infant gender					
Male	25	55.6	43	38.1	0.07‡
Female	20	44.4	70	61.9	
First milk					
Breast milk	30	66.7	66	58.4	0.44‡
Formula milk	15	33.3	47	41.6	
Timing of solid food introduction					
Early (<17 weeks)	7	15.6	14	12.4	0.79‡
Appropriate (17-26 weeks)	38	84.4	99	87.6	

* p-value <0.05 was significant **SD:** Standard deviation **IQR:** Interquartile range

! Body composition was not obtained on all infants in this sample at birth

ϰ Association between normally distributed continuous data assessed using an Independent Samples t-test

§ Association between non-normally distributed continuous data assessed using a Mann-Whitney U test

‡ Association between categorical variables assessed using the chi-squared test for 3x2 contingency tables

† Association between categorical variables assessed using the chi-squared test with Yates' Continuity Correction for 2x2 contingency tables

Binary logistic regression was performed to predict rapid weight gain between birth and 12 months of age. The multivariate model included the following variables: third level education, smoking at conception; smoking all throughout pregnancy, consuming alcohol in pregnancy, parity, infant gender and infant birth weight. While these variables were not all statistically significant on bivariate analysis, they were included in the multivariate model based on precedence from the literature (Griffiths *et al.*, 2010; Carling *et al.*, 2015). The model was statistically significant, χ^2 (7, *n*158) = 36.1, p<0.01, indicating that the model distinguished between infants who experienced rapid weight gain and those who did not. The overall model explained between 20.4% (Cox and Snell R Square) and 29.3% (Nagelkerke R Square) of the variance in rapid growth, and correctly classified 75.3% of all cases.

Of the seven independent variables, only gender (p<0.01) and birth weight (p<0.01) made statistically significant contributions to the model. The strongest predictor of rapid weight gain was male gender, where males were three times more likely to experience rapid weight gain compared to females (β = 1.115, odds ratio (OR): 3.05 [95% confidence interval (CI): 1.34-6.94]).

Term infants who weighed less at birth were also significantly more likely to experience rapid weight gain, where each gram increase in birth weight resulted in infants being 2.0% less likely to experience rapid weight gain (β = -0.002, OR: 0.98 [95% CI: 0.97-0.99]). The effects of the other independent variables in the model on rapid infant growth were mediated by the highly significant effects of gender and birth weight on growth in this small sample.

6.4.5 Measures of body composition at birth and at 12 months of age

Of the 158 infants in this sample, fat-free mass, fat mass and their associated relative proportions were obtained on a sub-sample at birth and 12 months of age, as shown in **Table 6.6a**.

Table 6.6a Body composition measurements at birth and at 12 months of age

	Birth† *n*145	12 months old‡ *n*85
Weight (grams)	3527.2 ± 431.7	9952.9 ± 1040.1
Fat-free mass (grams ± SD)	3016.8 ± 338.4	8765.2 ± 960.8
Fat mass (grams ± SD)	363.6 ± 154.2	1185.3 ± 278.7
Fat-free mass (% ± SD)	89.5 ± 3.7	88.1 ± 2.6
Fat mass (% ± SD)	10.5 ± 3.7	11.9 ± 2.6

SD: Standard deviation

† Body composition at birth measured by air displacement plethysmography

‡ Body composition at 12 months of age measured by bioimpedance analysis

When compared with female infants, male infants had significantly higher grams of fat-free mass at birth and at 12 months of age (**Table 6.6b**).

Table 6.6b Gender differences in body composition measurements taken on infants in the first year of life

	Male *n*68	Female *n*90	*p*-value*†
Birth			
Fat-free mass (grams ± SD)	3099.4 ± 351.3	2967.2 ± 331.4	**0.02**
Fat mass (grams ± SD)	338.5 ± 151.5	382.4 ± 154.4	0.09
Fat-free mass (% ± SD)	90.4 ± 3.5	88.8 ± 3.7	**<0.01**
Fat mass (% ± SD)	9.6 ± 3.5	11.2 ± 3.7	**<0.01**
	Male *n*38	Female *n*48	*p*-value*†
12 months of age			
Fat-free mass (grams ± SD)	9179.1 ± 881.7	8437.5 ± 899.6	**<0.01**
Fat mass (grams ± SD)	1295.6 ± 262.1	1097.9 ± 262.2	0.14
Fat-free mass (% ± SD)	87.6 ± 2.4	88.4 ± 2.7	**<0.01**
Fat mass (% ± SD)	12.4 ± 2.4	11.6 ± 2.7	0.14

* *p*-value of <0.05 was significant **SD:** Standard deviation

† Association between normally distributed continuous data assessed using an Independent Samples *t*-test

The relationship between weight and measures of body composition, *i.e.* fat-free mass and fat mass, at birth and at 12 months of age was also examined. In terms of fat-free mass at birth and birth weight, a strong positive correlation (r=0.93, n145, p<0.01) was observed (**Figure 6.1**). A strong positive correlation (rho=0.68, n145, p=0.01) was also observed between fat mass at birth and birth weight (**Figure 6.2**).

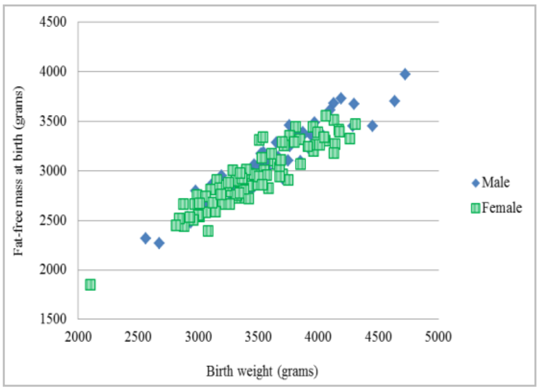

Figure 6.1 Relationship between fat-free mass at birth and birth weight

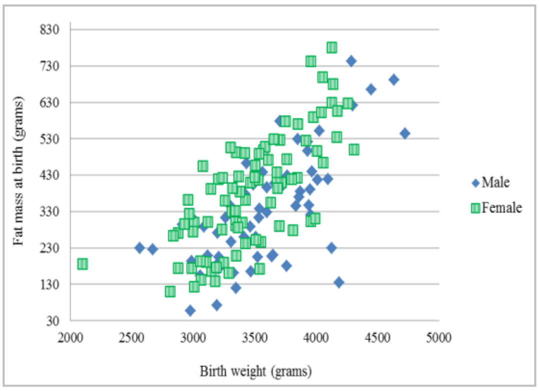

Figure 6.2 Relationship between fat mass at birth and birth weight

While a strong positive correlation (r=0.94, n86, p=0.01) was observed (**Figure 6.3**) between fat-free mass and weight at 12 months of age, a moderately positive correlation (r=0.40, n86, p=0.01) was observed between fat mass and weight at 12 months of age (**Figure 6.4**). Therefore, although an infant may have a higher body weight at 12 months of age, he does not necessarily have a higher fat mass (**Figure 6.4**).

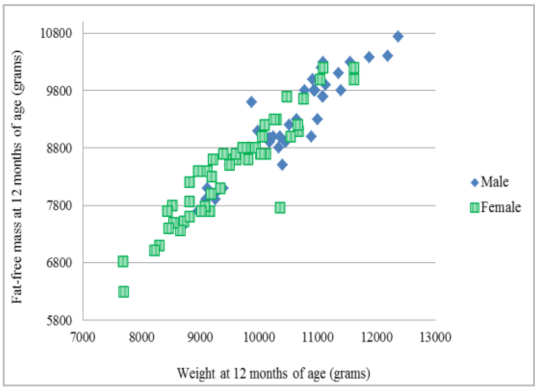

Figure 6.3 Relationship between fat-free mass and weight at 12 months of age

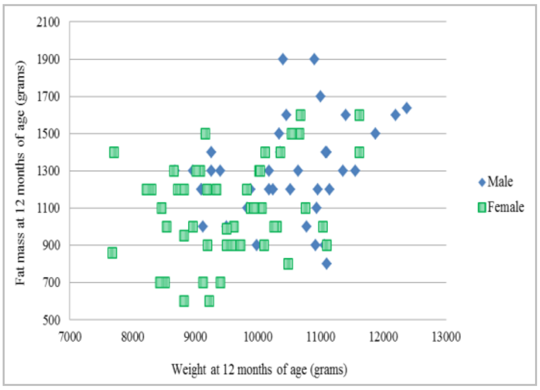

Figure 6.4 Relationship between fat mass and weight at 12 months of age

A moderately positive correlation (r=0.39, n81, p=0.01) was observed between fat-free mass at birth and fat-free mass at 12 months of age (**Figure 6.5**). However, although having a high fat-free mass at birth was associated with having a high fat-free mass at 12 months of age (**Figure 6.5**), fat mass at birth and fat mass at 12 months of age were not significantly correlated (rho=0.03, n81, p=0.78) (**Figure 6.6**).

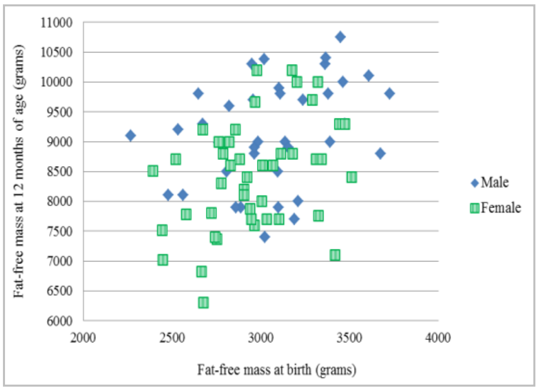

Figure 6.5 Relationship between fat-free mass at birth and at 12 months of age

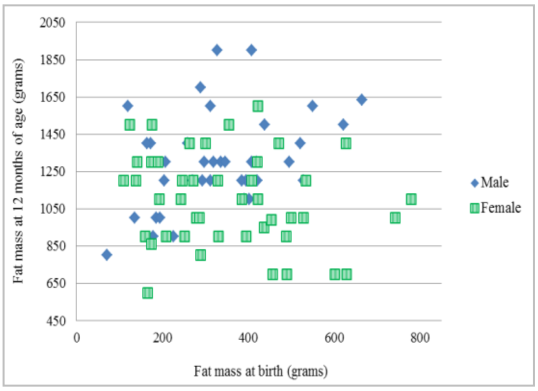

Figure 6.6 Relationship between fat mass at birth and at 12 months of age

In order to further investigate the characteristics associated with percentage body fat at birth, the measures of percentage body fat obtained at birth were divided into tertiles (**Table 6.7a**).

Table 6.7a Comparison between characteristics associated with percentage body fat at birth

Characteristic	% body fat in lowest tertile (*n*48)		% body fat in middle tertile (*n*49)		% body fat in highest tertile (*n*48)		*p*-value*†
	n	%	*n*	%	*n*	%	
Maternal education							
Third-level education	29	60.4	31	63.3	34	70.8	0.54
No third-level education	19	39.6	18	36.7	14	29.2	
Maternal social class							
High	22	45.8	25	51.0	22	45.8	
Middle	20	41.7	20	40.8	23	47.9	0.81
Low	6	12.5	4	8.2	3	6.3	
Parity							
Nulliparous	24	50.0	20	40.8	20	58.3	0.60
Multiparous	24	50.0	29	59.2	28	41.7	
Maternal body mass index							
≤24.9kg/m^2	32	66.7	24	49.0	18	37.5	**0.02**
≥25.0kg/m^2	16	33.3	25	51.0	30	62.5	
Gestational diabetes mellitus	0	0.0	2	4.1	2	4.1	0.36
Smoking at conception	15	31.3	15	30.6	17	35.4	0.86
Smoked in all three trimesters	4	8.3	6	12.2	3	6.3	0.58
Consumed alcohol during pregnancy	12	25.0	8	16.3	11	22.9	0.55
Maternal age at delivery							
≤24 years	5	10.4	4	8.2	3	6.3	
25-35 years	27	56.3	34	69.4	34	70.8	0.58
≥36 years	16	33.3	11	22.4	11	22.9	

* *p*-value <0.05 was significant ≤ Less than or equal to ≥ Greater than or equal to

† Association between categorical variables assessed using a chi-squared test for 3x2 contingency tables

Upon conducting a one-way between-groups ANOVA with post-hoc tests, infants whose percentage body fat at birth was in the highest tertile were significantly (*p*=0.03) more likely to have a mother with an obese pre-pregnancy BMI, compared to infants whose percentage body fat at birth was in the lowest tertile (**Table 6.7a**).

Percentage body fat at 12 months of age was also split into tertiles, and the associations between tertiles and various characteristics were examined (**Table 6.7b**).

Table 6.7b Comparison between characteristics associated with percentage body fat at 12 months of age

Characteristic	% body fat in lowest tertile (*n*30)		% body fat in middle tertile (*n*27)		% body fat in highest tertile (*n*29)		*p*-value*†
	n	%	*n*	%	*n*	%	
Maternal education							
Third-level education	20	69.0	16	59.3	20	66.7	0.73
No third-level education	9	31.0	11	40.7	10	33.3	
Maternal social class							
High	15	51.7	12	44.4	12	40.0	
Middle	12	41.4	10	37.0	15	50.0	0.60
Low	2	6.9	5	18.5	3	10.0	
Parity							
Nulliparous	13	44.8	11	40.7	12	40.0	0.92
Multiparous	16	55.2	16	59.3	18	60.0	
Maternal body mass index							
≤24.9kg/m^2	16	55.2	16	59.3	13	43.3	0.45
≥25.0kg/m^2	13	44.8	11	40.7	17	56.7	
Smoking at conception	7	24.1	7	25.9	15	50.0	**0.05**
Smoked in all three trimesters	2	6.9	1	3.7	7	23.3	**0.04**
Consumed alcohol in pregnancy	9	31.0	2	7.4	9	30.0	0.06
Infant receiving breast milk							
At birth	19	65.5	19	70.4	18	60.0	0.71
At 4 months of age	8	27.6	6	22.2	7	23.3	0.88
At 9 months of age	5	17.2	3	11.1	3	10.0	0.67
At 12 months of age	5	17.2	3	11.1	3	10.0	0.67
Rapid growth in first year‡	5	17.2	12	44.4	7	23.3	0.06
In non-parental childcare	22	75.9	17	63.0	18	60.0	0.40
Weaning age§							
Within recommendations	23	79.3	23	85.2	29	96.7	0.13
Outside recommendations	6	20.7	4	14.8	1	3.3	

* *p*-value <0.05 was significant ≤ Less than or equal to ≥ Greater than or equal to

† Association between categorical variables assessed using the chi-squared test for 3x2 contingency tables

‡ Indicated by a change in weight-for-length *z*-score of greater than 0.67 SD between birth and age one year

§ Recommended weaning age: Not before 17 weeks of age and not later than 26 weeks of age (Food Safety Authority of Ireland, 2011)

As shown in **Table 6.7b**, infants whose mothers smoked in the first trimester of pregnancy or throughout pregnancy were significantly more likely to have a percentage body fat in the highest tertile at 12 months of age.

6.4.6 Practical aspects of obtaining measures of body composition in infants

Body composition was measured by air displacement plethysmography and BIS in this study, and the logistics of measuring body composition by these methods will be described here.

The PEA POD air displacement plethysmography system (COSMED, Surrey, UK) measured body composition at birth. This system can accurately measure body composition despite subject movement. Therefore, one measurement was recorded for each of the 145 infants measured, and all 145 measurements recorded were valid.

The ImpediMed SFB7 BIS device (ImpediMed Ltd., Pinkenba, Queensland, Australia) was used to measure body composition at 12 months of age. BIS can be used to measure body composition from approximately ten months of age onwards. However, in order to obtain an accurate body composition measurement, a subject must remain still, thus making it challenging to use in paediatric populations. Despite each measurement lasting only 0.7 seconds, the device was set to record 55 measurements on each infant to account for their movement during measurement. Therefore, there was a greater likelihood of obtaining a higher number of accurate and 'noise-free' measurements for analysis if 55 measurements were taken on each infant.

Of the 141 infants who were measured using this device, some stable and 'noise-free' measurements were obtained on 85 infants, or 60.3% of the sample measured. Therefore, 7,755 measurements were obtained on 141 infants and each measurement was manually assessed to identify 85 readable measurements (0.01% of the total measurements taken). The utility of the ImpediMed in paediatric populations warrants closer examination and will be discussed further in the next section of this chapter.

6.5 Discussion

Many studies have identified associations between growth patterns in infancy and weight status in childhood (Baird *et al.*, 2005; Dennison *et al.*, 2006; Belfort *et al.*, 2007) and even adulthood (Stettler *et al.*, 2002; Bhargava *et al.*, 2004; Barker *et al.*, 2005; Ekelund *et al.*, 2007; Ylihärsilä *et al.*, 2008). Growth patterns in infancy have also been associated with the development of chronic diseases such as CVD and T2DM (Eriksson *et al.*, 2006; Barker *et al.*, 2007; Belfort *et al.*, 2007; Ekelund *et al.*, 2007; Singhal *et al.*, 2007; Norris *et al.*, 2012). In light of the associations between rapid growth in infancy and later weight and disease outcomes, infant growth remains an important area of health research.

This study aimed to gain insight into the rapidity and quality of growth amongst healthy term infants by assessing rates of weight gain and changes in body composition during the first year of life. Over a quarter of the infants measured in this study grew rapidly in the first 12 months of life. Unfortunately, the factors underlying these rapid growth patterns were not clearly elucidated, and the possible reasons for this will be discussed later. However, the study did identify some maternal characteristics and health behaviours which were associated with percentage body fat in infants at birth and at 12 months of age, and the implications of these findings will also be discussed.

The wider literature has already established that infant growth is a complex and not fully understood mechanism (Casazza *et al.*, 2013). It is influenced by genetic traits (Bouchard and Pérusse, 1993; Dubois *et al.*, 2007; Addo *et al.*, 2013), intrauterine influences (Misra *et al.*, 2011; Addo *et al.*, 2013; O'Tierney-Ginn *et al.*, 2014; Yajnik, 2014) and environmental factors (Bergmann *et al.*, 2003; Holzhauer *et al.*, 2009; Oyama *et al.*, 2009; van den Berg *et al.*, 2013; Carling *et al.*, 2015). Although this study did not identify many factors which were significantly associated with rapid weight gain in infancy, factors associated with changes in body composition were identified, and these factors do contribute to our understanding of the complex puzzle that is growth in the first year of life.

6.5.1 Anthropometric measurements and rapid growth in infancy

Anthropometric measurements obtained on infants at birth in this study were comparable to measurements reported in larger and nationally representative studies. The mean birth weight of infants in this study, at 3.55kg, compares favourably to the figures of 3.47kg and 3.50kg reported by Williams *et al.* (2010) and Hawkes *et al.* (2011), respectively. The proportion of infants who were large for their gestational age, *i.e.* >4.00kg at birth, was slightly higher in this study, at 15.3%, compared to the 11.3% of the total population of infants born in the Coombe Women and Infants University Hospital (2013). The average birth length in this study, at 51.2cm, was also similar to the 50.9cm reported by Hawkes *et al.* (2011) for infants born at 40 weeks gestation. Additionally, the mean head circumference of 35.1cm was in line with the figure of 34.8cm reported by a larger Irish cohort study (Hawkes *et al.*, 2011). Mid-arm circumference and abdominal circumference amongst infants at birth in this study were also similar to those measures reported by Hawkes *et al.* (2011).

Overall, the primary measures of growth at birth in this study were in line with those reported elsewhere. Therefore, these comparable measures formed a reliable baseline from which to monitor growth and weight gain throughout the first year of life.

It has been suggested that the *rate* at which an infant gains weight may be more important than birth weight in predicting the development of overweight and chronic disease (Eriksson *et al.*, 2003). Rapid growth in infancy is defined as a variation greater than 0.67 SD in WFL *z*-scores between two measurements (Ong *et al.*, 2000; Oyama *et al.*, 2009). In this study, over a quarter of infants had a WFL *z*-score in excess of 0.67 SD between birth and 12 months of age, a proportion similar to that reported by the Growing Up in Ireland study (Layte and McCrory, 2014).

When other factors were controlled for, however, only male gender and a lower birth weight predicted rapid growth in this study, when compared with female and higher birth weight infants, respectively. These two characteristics are inherently and naturally associated with an accelerated rate of growth (Layte and McCrory, 2014), and therefore do not provide any further insight into why this pattern of growth occurred. It was hypothesised that certain maternal sociodemographic and health behavioural characteristics, such as lower education (Teranishi *et al.*, 2001; Ekelund *et al.*, 2006; Wijlaars *et al.*, 2011; Layte and McCrory, 2014), smoking antenatally (Chen *et al.*, 2006; Dubois *et al.*, 2007; Oken *et al.*, 2007; Layte and McCrory, 2014), consuming alcohol antenatally (Oyama *et al.*, 2009), not breastfeeding (Arenz *et al.*, 2004; Beyerlein *et al.*, 2008; Koletzko *et al.*, 2009) and weaning before an infant was 17 weeks of age (Layte and McCrory, 2014), would be associated with a rapid growth pattern. Although these characteristics have not always been associated with rapid growth in the literature, it would be reasonable to expect that at least some of them may have influenced growth to some degree in this study (Dattilo *et al.*, 2012).

It is important to note that data were collected on a wide range of characteristics commonly associated with growth in this study. However, the sample size in this study meant that it was prudent to analyse many characteristics using as few categories as possible, *e.g.* BMI was analysed using the categories of healthy weight and overweight, as opposed to the categories of underweight, healthy weight, overweight and obese. It is likely that this manner of handling the data on sociodemographic and health behavioural characteristics – made necessary by the sample size available for analysis in this study – may not have permitted associations with rapid growth to be detected at an aggregated level, and so the factors associated with rapid growth in this study remain unclear.

That said, over a quarter of infants did undergo rapid growth in this study. Given the potentially adverse health outcomes of rapid growth in infancy, further research into modifiable dietary, behavioural and environmental practices associated with infant growth is needed. Once identified, these modifiable practices should be targeted with appropriate interventions from birth, if not before the birth of an infant (Monteiro and Victoria, 2005; Dattilo *et al.*, 2012). As will be shortly discussed, body composition at birth and at 12 months of age was associated with maternal health characteristics and behaviours prior to conception and during pregnancy, highlighting the importance of these periods for optimising infant growth and development outcomes.

6.5.2 Factors associated with infant body composition

In this study, percentages of body fat at birth amongst males, females and the full sample of infants were 9.6%, 11.2% and 10.5%, respectively. These measures of body composition at birth reflect the normative values reported by Hawkes *et al.* (2011), where percentages of body fat at birth amongst males, females and the full sample of 743 infants were 9.8%, 11.9% and 10.8%, respectively.

While normative values for percentage body fat at birth have been established (Hawkes *et al.*, 2011), no study to date has established an "ideal" percentage body fat at birth, or identified the long-term implications of percentage body fat at birth. However, it is thought that percentage body fat at birth may be an antecedent for later obesity (Ma *et al.*, 2004; Dattilo *et al.*, 2012), and that it may be a better indicator of the *quality* of infant growth when compared with birth weight alone (Pereira-da-Silva *et al.*, 2014). Therefore, this aspect of infant health has become a topic of close scrutiny in recent years (Farah *et al.*, 2011; Donnelly *et al.*, 2015; Horan *et al.*, 2015; Pereira-da-Silva *et al.*, 2015).

In this study, a higher percentage body fat in an infant at birth was associated with an obese pre-pregnancy BMI in their mother, a finding which has been reported elsewhere (Hull *et al.*, 2008; Pereira-da-Silva *et al.*, 2014; O'Connor *et al.*, 2015). A child's weight has been consistently and strongly associated with the weight of his mother (Dattilo *et al.*, 2012). Given that a mother provides genes and the intrauterine environment in which a foetus develops, it is expected that an infant's physical status at birth will reflect the physical condition of his mother during pregnancy (Dattilo *et al.*, 2012). Therefore, a woman's weight and, presumably, percentage body fat, before pregnancy may influence her infant's predisposition towards a higher percentage body fat, and therefore obesity (Danielzik *et al.*, 2002; Salihu *et al.*, 2009; Manios *et al.*, 2010), thus making this an important and potentially modifiable risk factor for undesirable infant growth.

While many studies have been conducted with the aim of helping pregnant women to gain a healthy amount of weight during pregnancy (McEachan *et al.*, 2016; Opie *et al.*, 2016), the author could not find any study which aimed to help women planning a pregnancy to attain a healthy weight. Although a sizeable minority of pregnancies in Ireland are unplanned (*safe*food, 2015), many women do plan their pregnancies. Therefore, it is worthwhile to impress upon all women of child-bearing age the importance of being a healthy weight prior to conception, and to devise appropriate interventions to help women planning a pregnancy to optimise their weight status prior to conceiving.

Alongside a mother's weight influencing infant body composition at birth, health behaviours during pregnancy appear to influence infant body composition at age one year. Infants whose mothers were smoking around the time of conception, or who smoked all throughout pregnancy, were significantly more likely to have a higher percentage body fat at age one year. Maternal smoking status is, of course, a modifiable risk factor for undesirable infant growth. In this study, almost a third of women were smoking around the time of conception, but only 8.2% smoked throughout their entire pregnancy. Despite many pregnant women ceasing to smoke, this finding highlights that smoking cessation on confirmation of pregnancy may be too late to prevent at least some smoking-related adverse health outcomes in the infant. Several observational studies have reported that the infants of mothers who smoked during pregnancy are at an increased risk of overweight (Oken *et al.*, 2008; Weng *et al.*, 2012). The finding that adiposity at 12 months of age is associated with smoking in pregnancy would seem to correspond with this observation. However, since body composition at age one year was measured on a small sample of 85 infants and the literature on body composition at this age is limited, further investigation into this association is warranted.

Infant body composition is a burgeoning area of research, and much more work remains to be done to determine optimum levels of percentage body fat at birth, in addition to determining the long-term health outcomes associated with elevated percentage body fat at birth. Investigation into how to manage an elevated percentage body fat in an infant at birth would also be worthwhile; however, even more valuable would be studies into measures which prevent an elevated percentage body fat at birth. Since this outcome appears to be so closely tied to a mother's health long before the birth of her infant, the necessity of protecting and promoting the health of child-bearing women cannot be overstated.

6.5.3 Practical aspects of measuring body composition in infancy

Body composition was measured by two methods in this study. At birth, body composition was measured using a PEA POD air displacement plethysmography system (COSMED, Surrey, UK). At 12 months of age, the ImpediMed SFB7 BIS device (ImpediMed Ltd., Pinkenba, Queensland, Australia) was used to measure body composition at 12 months of age.

The measurement of body composition at birth using the PEA POD posed no notable logistical issues, aside from assuaging maternal anxiety when their infant was within the measurement chamber of the PEA POD. Generally speaking, when body composition is measured, the subject must remain still in order for an accurate recording to be taken (Ellis, 2007; Ward *et al.*, 2007). However, air displacement plethysmography can accurately measure body composition despite subject movement (Ellis, 2007), so one measurement was recorded for each of the 145 infants measured, and all 145 measurements recorded were valid.

The PEA POD has been widely used in research for a number of years, and is considered a gold standard measure of body composition (Ma *et al.*, 2004). Infants weighing up to 10kg can be placed in the PEA POD for measurement, and therefore it is generally suitable for use until an infant is about six months old (Ma *et al.*, 2004). However, there is currently no gold standard device available to measure body composition between six months and two years of age. Therefore, a gap clearly exists in terms of measuring body composition in infancy, and the use of BIS in this study was an attempt to circumvent this shortcoming. However, when BIS is being used to measure body composition, the healthy and physiologically stable subject must remain *unmoving* in order for an accurate measurement to be recorded (Ellis, 2007; Ward *et al.*, 2007; Lingwood *et al.*, 2012). The ImpediMed SFB7 BIS device is portable and relatively inexpensive compared to other body composition devices, but the fact that a subject must remain still during measurement makes it challenging to use in paediatric populations (Lingwood *et al.*, 2012). Lingwood *et al.* (2012) successfully used the device amongst infants up to six months of age when validating the use of BIS against air displacement plethysmography. However, by 12 months of age, infants are considerably more mobile and often less willing to remain still, even for the length of one 0.7 second measurement. In this study, over 7,500 measurements were recorded and manually checked, and the vast majority were rendered invalid due to movement during the measurement; only 0.01% of the measurements recorded were used in analysis.

Despite the investment required to obtain these data, some important insights into the influence of maternal pre-pregnancy weight and antenatal smoking behaviours on infant body composition at age one year were obtained. However, it is important that the resources (*i.e.* time and cost) needed to obtain body composition data using an ImpediMed SFB7 in an infant population are accounted for in the planning of future research studies, and that investigation into devices which can accurately measure body composition in older infants, despite movement, continues.

6.5.4 Strengths and limitations of this study

In considering the study strengths and limitations, it must first be noted that the data presented here were collected as part of a longitudinal observational study conducted by the author in Dublin and its surrounding counties. Since all data was collected solely by the author, inter-observer error is not a concern, and is a particular advantage in terms of the repeated measurements of growth obtained. However, the study is not nationally representative, and, being an observational study, causal inferences cannot be made (Grimes and Schulz, 2002).

In terms of the quantitative data obtained, it is positive that repeated measures of maternal and infant sociodemographic characteristics and health behaviours were obtained. Internationally recognised definitions were also applied to the data obtained on milk feeding (WHO, 2004) and weaning (FSAI, 2011). However, although the sample size was sufficiently large for the models created through multivariate analysis, a number of categories within the sociodemographic characteristics and health behaviours were collapsed to ensure that there were enough cases within each category to meet the assumptions of the tests used. A larger sample size may negate the need to collapse categories and permit differences to be detected at a less aggregated level.

Despite these limitations, it is positive that measures of growth were obtained on four occasions during the first year of life, that the measures obtained were comparable to those in larger Irish studies (Hawkes *et al.*, 2011; Layte and McCrory, 2014), and that a gold standard technique was used to obtain infant body composition at birth.

6.6 Contribution to the literature

The measures of body composition obtained in this study are comparable to those obtained in a larger Irish study (Hawkes *et al.*, 2011), and therefore this study adds to the existing literature on body composition at birth. Furthermore, this is the first Irish study, to the author's knowledge, to use BIS to assess body composition at 12 months of age. Although an interesting association between percentage body fat at age one year and maternal antenatal smoking behaviours was identified, measuring body composition using the ImpediMed SFB7 BIS device was challenging. When the quantity of useable data obtained from this device is compared to the resources used to obtain that data, one can only conclude that further investigation into more efficient ways of measuring body composition in older infants is warranted.

6.7 Conclusion

The patterns of foetal growth and rapid weight gain in infancy have been repeatedly associated with subsequent obesity and chronic disease (Monteiro and Victoria, 2005; Ong and Loos, 2006; Ekelund *et al.*, 2007; Oyama *et al.*, 2009). Therefore, the period from conception to the end of the first year of life represents an important opportunity to identify modifiable factors which influence weight and body composition. Over a quarter of the infants in this study had rapid growth at some point in the first year of life, and although the factors underlying this growth pattern were difficult to elucidate, the wider literature emphasises the need to identify the factors associated with this pattern of weight gain. Identifying such factors may attenuate an individual's predisposition to overweight and its associated complications, and in so doing, the potential for improved physical and emotional health throughout childhood and beyond is exponentially increased.

6.8 References

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CHAPTER 7 Attitudes of fathers towards breastfeeding

The data presented in this chapter have been published in a peer-reviewed journal:

Bennett, A.E., McCartney, D., Kearney, J.M., 2016. Views of fathers in Ireland on the experience and challenges of having a breast-feeding partner. *Midwifery* 40, 169-176.

7.1 Introduction

Chapters four, five and **six** have explored maternal influences on breastfeeding and infant diet and growth. This chapter will bring the thesis full circle by returning to breastfeeding, but from the male perspective, and will explore how men support their breastfeeding partner in the early post-partum period.

7.1.1 Existing literature

Ireland has had a breastfeeding policy since 1994 (Department of Health, 1994), participated in the WHO-UNICEF Baby-Friendly Hospital Initiative since 1998, and implemented a national breastfeeding strategy since 2005 (Department of Health and Children, 2005). Despite these measures, and despite the widely promoted physical and emotional benefits of breastfeeding for mother and infant (Gartner *et al*., 2005), rates of breastfeeding initiation and duration in Ireland remain well below those of our European counterparts (Brick and Nolan, 2014).

Ireland has not had a breastfeeding culture for several generations (Curtin, 1954; Kevany *et al.*, 1975; McSweeney and Kevany, 1982; Fitzpatrick *et al.*, 1994; Brick and Nolan, 2014). As such, the skill of breastfeeding has been lost to the social and cultural network of many women in Ireland. Health professionals have been identified as important to the success of breastfeeding (Begley *et al.*, 2008; Tarrant *et al.*, 2011; Whelan and Kearney, 2014), but with shorter hospital stays, the potential contribution of a mother's family network to the success of breastfeeding cannot be dismissed.

The support offered by a woman's partner affects her decision to initiate and continue breastfeeding (Scott *et al.*, 2001; Pisacane *et al*., 2005; Pontes *et al*., 2008; Susin and Giugliani, 2008). The only Irish study to date which assesses the attitude of fathers to breastfeeding (Kenosi *et al*., 2011) reported that while most of the fathers surveyed discussed infant feeding methods with their partner, only a third felt that it was a shared decision between both parents. Brown and Davies (2014) similarly reported that while fathers were often positive about breastfeeding, most ultimately referred to breastfeeding as their partner's choice. While it is important that a woman's autonomy to choose is respected, it is also important that fathers feel included in, and important to, the breastfeeding process from the outset. This is important since fathers who are removed from the breastfeeding process can feel frustrated, alienated and helpless (Barclay and Lupton, 1999; Goodman, 2005; Pontes *et al*., 2009; Brown and Davies, 2014) when it comes to supporting the needs of their breastfeeding partner and infant.

Several studies have investigated reasons why mothers in Ireland never initiate, or discontinue, breastfeeding. These reasons often relate to the perceived negative impact of breastfeeding on lifestyle, difficulty with breastfeeding techniques and perceived milk insufficiency (Begley *et al*., 2008; Tarrant *et al*., 2009; Tarrant *et al*., 2011; Layte and McCrory, 2014). Therefore, mothers often avoid or discontinue breastfeeding due to technical difficulties and poor practical and emotional support.

The results of studies investigating the impact of paternal involvement on breastfeeding have been somewhat mixed to date. However, most indicate that helpful paternal involvement has a significant positive impact on some aspect of breastfeeding, whether it is initiation (Wolfberg *et al*., 2004), feeding on discharge (Scott *et al*., 2001; Tarrant *et al*., 2011), duration (Pisacane *et al*., 2005; Tarrant *et al*., 2011; Maycock *et al*., 2013), or coping with breastfeeding difficulties (Pisacane *et al*., 2005).

The Irish study by Kenosi *et al.* (2011) reported that only 55.2% of fathers had enough information on breastfeeding. Irish women who breastfeed are in the minority from the early post-partum period, with national figures reporting that only 42.5% of Irish mothers do any breastfeeding on discharge from hospital (Layte and McCrory, 2014), which is often within 48 hours of giving birth (Coombe Women and Infants University Hospital [CWIUH], 2013). A better understanding of male attitudes and knowledge around breastfeeding is needed to enhance breastfeeding support for women.

7.1.2 Knowledge gaps

Only one study (Kenosi *et al.*, 2011) has been conducted to date on the attitude of fathers in Ireland towards breastfeeding. This study had a small sample of 67 fathers who answered the study questionnaire within two days of the birth of their child. As such, very little is known about the experience of fathers in Ireland with breastfeeding. Considerable work remains to be done to increase Irish breastfeeding rates; this work must include recognition of the paternal role in breastfeeding support.

7.2 Aims and objectives

The overall aim of this study was to gain insight into the relationship between men and breastfeeding in Ireland. The specific objectives were to determine:

- The role of a father in the decision to breastfeed;
- Helpful sources of information for fathers on breastfeeding;
- Aspects of breastfeeding for which fathers felt unprepared;
- The ability of fathers to assist with the challenges of breastfeeding;
- Advantages and disadvantages to having a breastfeeding partner;
- Preferred bonding practices with a breastfed infant; and
- The attitudes of fathers towards breastfeeding in public.

7.3 Methodology

The general methodology for this fieldwork is described in **chapter two**, **section 2.11**. A piloted cross-sectional questionnaire (Appendix 20) was posted to 1,405 fathers whose partner had given birth to a healthy infant four to seven months previously in the Coombe Women and Infants University Hospital (CWIUH).

7.3.1 Questionnaire items

Due to the lack of published data on the experience of becoming a father in Ireland, the questionnaire was largely exploratory in nature and contained a mix of closed-ended and open-ended questions. The questionnaire collected data on the views of fathers on pregnancy, milk feeding and coping in the post-partum period. However, given the paucity of Irish data on fathers and breastfeeding, this chapter will specifically focus on the interpretation of the data obtained on the experiences of fathers who had a breastfeeding partner.

Fathers with partners who had breastfed their last (or only) child were asked closed-ended questions on:

- *Their role in the decision to breastfeed:* If a father stated that they had been involved in the breastfeeding decision, they had to select whether they encouraged, discouraged or were ambivalent about, breastfeeding, when the decision on milk feeding was being made.
- *Useful sources of information on breastfeeding:* Fathers had to tick their most useful sources of breastfeeding from a list which included: their partner, lactation consultant, midwife, public health nurse, family member and internet. Fathers could add a source which was not included on the predefined list.
- *Their ability to assist with the challenges of breastfeeding:* Fathers had to choose from one of three options: (1) My partner had no difficulty with breastfeeding; (2) I had enough information to help my partner with breastfeeding difficulties; or (3) I did not have enough information to help my partner with breastfeeding difficulties.
- *Preferred bonding activities with a breastfed infant:* A list of common bonding activities was provided (*e.g.* bathing baby, changing baby, putting baby to sleep), from which fathers could choose their preferred bonding activity or add their own activities.

Open-ended questions obtained data on: aspects of breastfeeding for which fathers felt unprepared; information on breastfeeding which fathers would have liked to have had in the antenatal period; and, advantages and disadvantages to having a breastfeeding partner.

A photo of a woman discreetly breastfeeding was also shown (**Figure 7.1**). Fathers were asked what they would be likely to feel should they see a woman unrelated to them feeding in this way in everyday life. The list of potential reactions included: gladness, respect, surprise, indifference, embarrassment, discomfort and disgust.

Figure 7.1 Image used to obtain data on how fathers would feel were they to see a woman breastfeed in the manner shown in everyday life

Fathers were also asked how comfortable they would feel if their own partner ever chose to breastfeed in public. Fathers had to choose from one of three options: completely comfortable with no concerns; fairly comfortable but with a few concerns; or completely uncomfortable with a lot of concerns. If fathers felt concern over their partner breastfeeding in public, they were asked to state the nature of their concern.

Finally, sociodemographic data were collected on age, parity, education level, employment status and marital status.

7.3.2 Data handling and analysis

Data were entered into SPSS for Windows, version 22.0 (IBM, New York, United States). Normally distributed data on age and parity were summarised numerically using the mean ± standard deviation (SD). Data obtained from closed-ended questions were presented using frequencies and associated percentages.

The answers to open-ended questions were analysed using content analysis (Sandelowski, 2010). Content analysis presents a description of, and puts into context, what respondents said, without drawing deep implications from the data. To analyse the answers to open questions, the researcher took a sample of approximately 60 questionnaires and read the answers given for each open-ended question on breastfeeding. A list of frequently recurring themes was devised from these answers to each open-ended question. For example, a recurring theme amongst the answers given to the question on aspects of breastfeeding for which fathers felt unprepared was the *time commitment required to breastfeed*. Each theme was assigned a numerical code and when that theme occurred amongst the answers given in later questionnaires, the code for that theme was assigned to the answer given.

Therefore, all answers given to open-ended questions were categorised according to a particular theme. Each theme was assigned a numerical code which was entered into SPSS. All resulting codes were quantitatively counted and presented as frequencies and percentages. Answers from fathers which best described a particular theme were then used to illustrate the final frequencies and percentages given.

7.4 Results

Of the 1,405 questionnaires posted to fathers, seven questionnaires were returned undelivered, resulting in 1,398 eligible questionnaires. Of these, 583 fathers returned a completed questionnaire, giving a response rate of 42%. Of the completed questionnaires, 417 (71.5%) men had a partner who initiated breastfeeding. This chapter will focus on the data obtained from the 417 fathers who had a breastfeeding partner. The sociodemographic characteristics of these fathers are provided in **chapter three**, **Table 3.7**.

However, to summarise, the mean age of fathers was 36.3 (SD ± 4.7) years and the majority (62.6%, *n*261) had at least one other child (mean 1.6 other children). Most had completed a college degree (76.7%, *n*320) and were in full-time employment (91.6%, *n*382). Most were married (87.8%, *n*366), and of those who were unmarried (12.2%, *n*51), less than half (49.0%, *n*25) had guardianship rights over their child.

7.4.1 Preparation and support for breastfeeding

Over three-quarters (75.5%, *n*315) of fathers were involved in the decision to breastfeed. Most of these fathers (72.7%, *n*229) encouraged their partner to breastfeed, while 6.7% (*n*21) would have preferred that their partner didn't breastfeed. A fifth (20.6%, *n*65) of fathers reported discussing breastfeeding without actively influencing their partner, thus ultimately remaining ambivalent and leaving the final decision with her.

The most important sources of information on breastfeeding listed by fathers were: past experience of having a breastfeeding partner (30.0%, *n*125); their partner's instructions (26.9%, *n*112); the advice of a lactation consultant (8.4%, *n*35); and the internet (7.4%, *n*31). Almost one in eight fathers (12.9%, *n*54) reported not feeling any need for information on breastfeeding.

The majority (56.8%, *n*237) of fathers reported that their partner experienced some difficulty breastfeeding. Of these, half (50.6%, *n*120) had enough information to help their partner to overcome her breastfeeding difficulties, and half (49.4%, *n*117) did not.

Almost half (49.9%, *n*208) of fathers suggested types of information which they believed would have made breastfeeding easier for their partner (**Table 7.1**). The most common (45.2%, *n*94) type of preferred information was consistent practical advice on how to troubleshoot common breastfeeding difficulties, to include latching difficulties, blocked ducts, tongue tie and mastitis.

Table 7.1 Most common types of information which a sample of 208 fathers in Ireland felt would have made breastfeeding easier for their partner

Type of information	*n*	%	Typical quote
Consistent practical advice and assistance from the outset	94	45.2	*"A 'Top Tips' leaflet would be beneficial, with a section on 'What to do when [insert difficulty] ..."* *"Proper information in hospital – every midwife gave conflicting information. A lactation consultant visit should be mandatory for every breastfeeding mum."* *"All of the different positions to breastfeed. My wife found that lying down on the bed with the baby was the easiest way to start."*
Being aware, before birth, of the potential difficulties associated with establishing breastfeeding	47	22.6	*"Knowing that just because you were able to do it first time around doesn't mean it will be easy or easier the second time around."* *"Going to a breastfeeding class during the pregnancy, so that the difficulties were less of a shock."*
Understanding the production of adequate volumes of breast milk	21	10.1	*"If I had known that allowing formula feeding too soon was the death knell for breastfeeding, I would have tried to help more and fight for it."* *"Understanding timings with supply and when to feed to keep supply going."*
Clearer understanding of the role of the father in breastfeeding	11	5.3	*"I think fathers should be encouraged to attend groups or consultants regarding breastfeeding, I feel it is a 'woman's world' when it comes to these things."* *"Knowing how I was meant to support her when there were problems or when she was finding it tough-going."*
Having non-judgemental individuals with whom to discuss breastfeeding	9	4.3	*"She was called 'earth mother' by other women, so maybe educate the rest of the country to remove the stigma."* *"A lack of the almost religious-like devotion to the cause of breastfeeding would have helped – a more balanced approach."*

7.4.2 Aspects of breastfeeding for which fathers felt unprepared

Over three-quarters (77.5%, *n*323) of fathers described aspects of breastfeeding for which they were unprepared (**Table 7.2**). The most common (52.6%, *n*170) of these was the difficulty that their partner encountered in learning to breastfeed; that breastfeeding didn't 'just happen'.

Table 7.2 Aspects of breastfeeding for which 323 fathers in Ireland commonly felt unprepared

Aspect	*n*	%	Typical quote
Difficulty encountered by partner when establishing breastfeeding	170	52.6	*"The lack of honesty about how difficult and painful it is, that it's not a straightforward choice."* *"The damage caused to breasts – her nipples cracked and her ducts got blocked."* *"It's very difficult for something that should come naturally – it's physically and emotionally draining. It takes time to master the art of breastfeeding."*
Time commitment required by their partner to breastfeed	60	18.6	*"The constant feeding – up to 12 hours a day for 12 weeks."* *"How time-consuming it was at the start – it was all we talked about for weeks."*
The bond between mother and infant	39	12.1	*"How comforting both my wife and baby found it."*
The methods of producing breast milk	18	5.6	*"That if she wanted to express, it helped if she just thought about feeding the baby!"* *"That a breast pump does not get as much milk as the baby would when he's feeding."*
Feelings of exclusion due to infant's dependence on mother	10	3.1	*"I was not expecting to be so unneeded."* *"Less included – I felt like I was sitting on the outside looking in."*

Fathers were also unprepared for the: lack of readily available professional support from the public health service; possibility of partial breastfeeding; intensity of the mother-infant bond; size of their partner's breasts; and the number of calories required to breastfeed.

7.4.3 Perceived advantages to having a breastfeeding partner

Of the fathers who listed advantages to having a breastfeeding partner (86.8%, *n*362), the most common advantages included the: health benefits for their infant (49.4%, *n*179); having to do no night feeds (38.7%, *n*140); the convenience of breastfeeding compared to formula feeding (30.4%, *n*110); and the strength of the mother-infant bond (17.4%, *n*63).

7.4.4 Perceived disadvantages to having a breastfeeding partner

While 12.7% (*n*53) of fathers reported no disadvantages to having a breastfeeding partner, most fathers (77.7%, *n*324) with a breastfeeding partner listed at least one disadvantage (**Table 7.3**).

Table 7.3 Common disadvantages to having a breastfeeding partner experienced by a sample of 324 fathers in Ireland

Disadvantage	*n*	%	Typical quote
Coping with the effects that full responsibility for feeding can have on a mother	190	58.6	*"Wife is tired and grumpy from never getting 8 hours of straight sleep."* *"It was so hard on her. It wore her down. I hated seeing her so stressed, strapped to that breast pump for weeks."*
Less opportunities to bond with infant	133	41.0	*"Building a bond with the baby. I was left out on the edges a little."* *"Breastfeeding forces the Dad out of an important and rewarding job."*
Anxiety over the success of breastfeeding	53	16.3	*"Our uncertainty over how much the baby was consuming, even with lots of solid nappies."* *"My partner felt like a failure every time she made a bottle of formula."* *"My wife was unable to breastfeed for more than a couple of days. She took this inability very hard and saw herself as a failure. I deeply resent the 'breast is best' campaign and the detrimental effect it has on those unable to breastfeed, especially as pregnancy leaves women very tired emotionally and physically."*
Less regular routine (*e.g.* due to unpredictable feeding patterns, frequent night feeds or difficulties leaving the house if partner was uncomfortable feeding in public)	47	14.5	*"Wife can't stay out for too long without bringing a pump, and her handbag is full enough anyway."* *"Some people can act very strangely if a woman breastfeeds in public, so it's hard for her to breastfeed outside the house."*

The most common disadvantage (58.6%, *n*190) was being unable to assist with feeding and coping with the resultant effects (*e.g.* tired, weepy, cantankerous) that this can have on their partner's emotional state. Two-fifths (41.0%, *n*133) of fathers also highlighted their concerns regarding the reduced number of opportunities to bond with their infant (**Table 7.3**). Other disadvantages included: decreased intimacy with their partner; feelings of jealousy over the mother-infant bond; and managing sibling rivalry for maternal attention.

7.4.5 Preferred bonding activities with a breastfed infant

To compensate for the lack of feeding time, fathers engaged in other bonding activities with their infant, with many fathers highlighting multiple bonding activities. These activities included: nappy-changing, bathing their infant, playing, reading, massage, doing skin-to-skin, chatting, swimming, and going on walks.

7.4.6 Views on breastfeeding in public

All fathers (*n*417) were asked about their predominant feeling to seeing a woman who was not their partner breastfeed in public. The majority of fathers (56.6%, *n*236) reported that they would feel indifferent and almost a third (32.1%, *n*134) reported that they would feel respect for a woman unrelated to them breastfeeding in public. Almost one in ten (9.4%, *n*39) reported feeling uncomfortable and a small number (1.9%, *n*8) of fathers reported feeling surprise at seeing a woman breastfeed in public.

When fathers were asked about their reaction should their own partner ever breastfeed in public, the majority of fathers (65.7%, *n*274) reported that they would be completely comfortable with this. Less than a third (30.9%, *n*129) reported that they would be fairly comfortable with a few concerns, while just 3.4% (*n*14) of fathers stated they would be completely uncomfortable with a lot of concerns. The specific types of concerns expressed by fathers are listed in **Table 7.4**.

Table 7.4 Concerns held by a sample of 143 fathers in Ireland should their partner ever breastfeed in public

Concern	*n*	%	Typical quote
Other people staring at partner's breasts during feeding	50	35.0	*"Some young lads or perverts taking a sneaky look at her."* *"Boobs on display for other people."* *"That people might stare at her."*
Causing offence or discomfort to other people in the vicinity	47	32.9	*"Other people not approving or frowning upon it."* *"Paranoid that other blokes would feel uncomfortable."* *"It's uncomfortable for everyone around."*
Feeding is not discreet enough	29	20.3	*"Dignity of mother in an exposed situation."* *"We have a very strange society where social networks rule. I would be afraid of someone filming and putting it on the internet. I also think that it's a private thing."* *"I would prefer if it was done discreetly. I don't think it's appropriate to be doing it in public, but if you need to, cover it up."*
Inappropriate comments which make partner feel uncomfortable	18	12.6	*"That ignorant people may say something and make her feel uncomfortable."*

7.5 Discussion

With Irish breastfeeding rates being amongst the lowest globally (Gallagher *et al*., 2015), ongoing investigation into the adequacy of breastfeeding support in Ireland is warranted. Fathers can provide a continuity of care which other sources of breastfeeding support cannot, so it is important to consider the potentially beneficial role of fathers in Ireland in breastfeeding promotion. This study indicates that while fathers are largely supportive of the concept of breastfeeding, significant challenges remain in terms of their ability to support breastfeeding in an informed and practical manner.

7.5.1 Influence of paternal support on the breastfeeding decision

In terms of supporting mothers to initiate breastfeeding, the majority of fathers in this study reported encouraging their partner to breastfeed. Paternal support has been repeatedly shown to affect the decision to initiate and maintain breastfeeding (Scott *et al*., 1997; Binns and Scott, 2002; Hauck, 2004; Pisacane *et al*., 2005; Pontes *et al*., 2008). For example, Wolfberg *et al*. (2004) reported that women whose partner had attended a breastfeeding class with other fathers during pregnancy were significantly more likely to initiate breastfeeding compared to a control group. Scott *et al*. (2001) reported that women who perceived that their partner was supportive of breastfeeding were 11 times more likely to breastfeed on discharge from hospital, and mothers who have an informed partner who is supportive of breastfeeding are significantly more likely to successfully cope with breastfeeding difficulties in the early post-partum period (Pisacane *et al*., 2005). Therefore, paternal support has been associated with improved rates of breastfeeding initiation (Arora *et al*., 2000; Wolfberg *et al*., 2004), breastfeeding upon hospital discharge (Scott *et al*., 2001) and breastfeeding duration (Ingram and Johnson, 2004; Pisacane *et al*., 2005; Nickerson *et al*., 2012; Maycock *et al*., 2013).

7.5.2 Educating fathers to help them to support the breastfeeding process

Once breastfeeding commenced in this study, however, over three-quarters of fathers in this study reported feeling unprepared for different aspects of breastfeeding. Most commonly, fathers were unprepared for the difficulty and pain that their partner experienced during breastfeeding, with over half of fathers being unable to help their partner overcome breastfeeding challenges when she experienced them.

Perceived milk insufficiency is the most commonly recorded challenge which results in the cessation of breastfeeding amongst Irish mothers (Layte and McCrory, 2014). Educating fathers on how to troubleshoot common breastfeeding challenges has been associated with higher breastfeeding rates at six months post-partum (Scott *et al*., 2001; Pisacane *et al*., 2005). Ingram and Johnson (2004) reported that a 30-minute information session at home with both parents based on a leaflet containing practical breastfeeding advice significantly increased breastfeeding duration compared to controls, with most fathers reporting that they referred back to the leaflet after the session. Pisacane *et al.* (2005) reported that the delivery of 40 minutes of breastfeeding education to groups of fathers in the antenatal period increased breastfeeding duration and resulted in significantly lower rates of perceived milk insufficiency. Another intervention (Tohotoa *et al*., 2010) found that 60 minutes of breastfeeding education antenatally helped fathers to develop more realistic expectations of feeding and to acquire practical knowledge on ways to manage the challenges of breastfeeding.

Irish maternity hospitals currently do not provide fathers with dedicated instruction on breastfeeding, but as the aforementioned studies report, even 30 minutes of paternal breastfeeding education can have a significantly positive influence on breastfeeding outcomes. With a mother's typical hospital stay post-birth being less than two days (CWIUH, 2013), fathers are a potentially invaluable source of support to help sustain feeding in the early post-partum period, especially when a mother's milk supply is not yet established and she is still learning to breastfeed. Since pregnancy is a unique time during which both parents are simultaneously in contact with health professionals over the care of their child, engaging more closely with fathers to promote breastfeeding is an important consideration for maternity services (Rempel *et al*., 2016).

Fathers in this study clearly identified advantages to breastfeeding and expressed the desire to meaningfully help their partner to breastfeed. Fathers wanted practical feeding information, not only on fundamental aspects of feeding such as optimal feeding positions and factors that affect milk production, but also on helpful ways to practically and emotionally support their breastfeeding partner. The means by which fathers can help their breastfeeding partner may not be immediately apparent to them (Henderson *et al*., 2011; Sherriff and Hall, 2011), and providing guidance on useful types of support may help fathers to feel more included and competent when it comes to the care of their infant (Ingram and Johnson, 2004; Brown and Davies, 2014). Preferred forms of practical support reported by mothers include cooking, doing housework, caring for other children, bathing the infant, bringing infant to mother for night feeds and helping the mother to relax (Tohotoa *et al*., 2009; Rempel and Rempel, 2011). Helpful emotional supports include praise for her breastfeeding efforts, compliments on her progress with breastfeeding, and defending the mother from individuals advocating formula feeding (Tohotoa *et al*., 2009; Rempel and Rempel, 2011; Nickerson *et al*., 2012).

7.5.3 Bonding with a breastfed infant

Alongside helping their partner to succeed with breastfeeding and their mothering role, fathers also wanted to flourish in their fathering role and develop a strong relationship with their infant. Despite all fathers identifying bonding activities which help them to compensate for not feeding their infant, a significant minority of fathers expressed concerns about the perceived impact of feeding deprivation on the father-infant bond, a finding reported elsewhere (Goodman, 2005; Rempel and Rempel, 2011; Nickerson *et al*., 2012). Since men frequently report feeling helpless during pregnancy and childbirth (Dellman, 2004; Longworth and Kingdon, 2011), it is unsurprising that they wish to have an active role with the essential task of feeding. Fathers of breastfed infants often feel alienated from the mother-infant bond that forms (Barclay and Lupton, 1999; Goodman, 2005) and jealous of the privileged position a breastfeeding mother holds as the sole food provider (Rempel and Rempel, 2011; Nickerson *et al*., 2012). However, the intimacy created by breastfeeding cannot be replicated with bottle-feeding, so fathers won’t necessarily enjoy the same closeness feeding their infant as a mother does. Therefore, fathers should be reassured that they can still develop a warm and nurturing role as the non-food parent, without compromising the frequency or duration of breastfeeding. To help promote this, health professionals should reiterate the value of a father to the success of breastfeeding and provide unambiguous advice to both parents on how a father can be meaningfully involved in the feeding process.

7.5.4 Inclusion of fathers in maternity services and breastfeeding policies

Unfortunately, inconsistent advice from health professionals was listed as an issue which stymied the efforts of fathers to support breastfeeding in this study, and is a finding reported elsewhere (Brown and Davies, 2014; Whelan and Kearney, 2014; Hunter *et al*., 2015). A more concerted effort by health professionals to include fathers may be possible if the role of fathers in breastfeeding is more pointedly acknowledged in national strategies and policies. For example, the most recent Irish breastfeeding strategy (Department of Health and Children, 2005) refers to the need to include partners in the maternal breastfeeding network, but does not specify how this is to be done. Since the two main disadvantages to having a breastfeeding partner in this study related to being unable to adequately support their partner and feeling deprived of bonding time, the role and value of fathers in the maternal breastfeeding network should be clearly conveyed throughout pregnancy and the post-partum period.

7.5.5 Views of fathers on breastfeeding in public

It is of note that while one in ten fathers reported feeling uncomfortable on seeing an unrelated woman breastfeeding in public, this increased to three in ten if the woman in question was their partner. The main reasons for feeling discomfort included possible infringements upon their partner's modesty and causing offence to those in the surrounding environ. Importantly, the concerns of fathers in this study regarding breastfeeding in public are not dissimilar to the concerns voiced by mothers in other studies (Sheeshka *et al*., 2001; Ahluwalia *et al*., 2005; Keely *et al*., 2015). This restrictive attitude towards breastfeeding in public does not always indicate a lack of support for breastfeeding (Scott *et al*., 1997; Spurles and Babineau, 2011; Vieth *et al*., 2016). Rather, there seems to be a conflict between balancing conservative cultural and social norms with the necessity of the naturally intimate process of breastfeeding.

Social support and cultural norms significantly affect the initiation and duration of breastfeeding (Li *et al*., 2002; McFadden and Toole, 2006; Brown *et al*., 2011; Boyer, 2011; Vari *et al*., 2012). Ireland has a strong formula feeding culture (Carroll *et al*., 2015), where breastfeeding beyond the first few weeks post-partum has been marginal for several generations (Curtin, 1954; Kevany *et al*., 1975; McSweeney and Kevany, 1982; Fitzpatrick *et al*., 1994; Brick and Nolan, 2014). As such, the general population in Ireland has scant exposure to women breastfeeding in public.

Women have reported feeling vulnerable and embarrassed while breastfeeding in public (Earle, 2002; Begley *et al*., 2008), even in the absence of negative attention (Sheeshka *et al*., 2001). Negative reactions to unfamiliar practices are to be expected; what is important to note is that such reactions generally become more positive with increased familiarity (Greene *et al*., 2003; Spurles and Babineau, 2011). Therefore, an environment which promotes breastfeeding as an essential everyday activity can foster a more tolerant attitude towards breastfeeding in public. However, normalising breastfeeding in a country with an embedded formula feeding culture will require extensive promotion of breastfeeding within schools, colleges, health services, workplaces, businesses and public spaces. Furthermore, pregnant women should be informed about their right to breastfeed in public and can be given advice on how to breastfeed discreetly to bolster their confidence in their ability to breastfeed in public (Sheeshka *et al*., 2001).

7.5.6 Strengths and limitations of this study

Before drawing final conclusions on the findings of this fieldwork, the methodological strengths and limitations must be considered.

Postal questionnaires have an average response rate of approximately 56% (Nulty, 2008). Strategies to increase questionnaire response rates in this study included: personally addressed envelopes; personalised hand-signed letters; the use of coloured ink; the inclusion of a stamped addressed envelope and pen; the use of a university logo; providing assurance of anonymity; and the inclusion of an acceptable number of questions (Edwards *et al*., 2002; Nulty, 2008). Despite these measures being taken, this questionnaire had a response rate of 42%. While this response rate is less than anticipated, 417 questionnaires was adequate for this analysis, and the group of fathers to which the results best apply is known from the sociodemographic data collected.

From the sociodemographic data collected, this questionnaire represents fathers who were more educated and had a lower rate of unemployment compared to the national population. The breastfeeding initiation rate of 71.5% reported in this study was also higher than the national initiation rate of 50.1% amongst Irish mothers (Layte and McCrory, 2014). Furthermore, respondents were self-selected and in light of the topic being investigated, may have been biased towards providing responses perceived as socially desirable. However, the anonymity of the questionnaire should encourage a more frank expression of views held on breastfeeding (Lippitt *et al*., 2014).

While this study does not represent younger or less well-educated fathers, it is one of the first studies in Ireland to provide important insights on breastfeeding from well-educated fathers who are in stable relationships and who are actively involved in the upbringing of their children. Future research should investigate the views of younger fathers and fathers from more disadvantaged backgrounds, and should identify other ways of encouraging men in Ireland to take part in research related to fatherhood.

7.6 Contribution to the literature

This is the largest study conducted to date on the views of fathers in Ireland on breastfeeding.

This study represents a socioeconomically advantaged and educated sample of fathers. Despite this, the study indicates that while these fathers are often well-disposed towards the idea of breastfeeding, a substantial proportion of them do not possess the knowledge required to offer adequate technical and emotional breastfeeding support to their partner. The study also highlights the feelings of exclusion experienced by fathers of breastfed infants, and the difference in attitudes towards unrelated women breastfeeding in public *versus* the mother of their infant breastfeeding in public.

Overall, this study has shed light on the need to educate fathers on how they can participate in the process of breastfeeding in a way which empowers their partner and which meaningfully includes them, without compromising the frequency or duration of breastfeeding.

7.7 Conclusion

Despite the undisputed benefits of breast milk (Gartner *et al*., 2005), the rate of breastfeeding in Ireland remains low by international standards (Brick and Nolan, 2014). The increase in rates of breastfeeding in recent years is largely due to non-modifiable maternal characteristics, such as increasing maternal age and higher numbers of non-national women giving birth here (Brick and Nolan, 2014). Therefore, existing policy initiatives have been largely ineffective in creating a more balanced infant feeding culture amongst Irish women.

Fathers can play a critical role in providing support to mothers and infants, and the lack of meaningful engagement with fathers and fathers-to-be is a missed opportunity for breastfeeding promotion. The core of a breastfeeding family consists of mother, infant and father, and all three must be recognised as cornerstones to successful breastfeeding. If fathers are more effectively included in the breastfeeding process, mothers will feel better supported, fathers will feel less excluded, and infants will reap the benefits of an environment in which breastfeeding is the norm.

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CHAPTER 8 Final discussion and conclusions

8.1 Introduction

The year before, and the year after, the birth of an infant have profound consequences for infant health and wellbeing. The health of an infant is underpinned by the health behaviours of his parents, and thus investigation into the former must be accompanied by investigation into the latter.

This thesis examined four distinct but inter-related topics related to infant growth and development. The associations between maternal wellbeing and infant milk feeding were examined in **chapter four**. The views of fathers on their role in infant milk feeding were explored in **chapter seven**, and the ways in which these two chapters are related are discussed further here. This thesis also examined the progression from exclusive milk feeding in **chapter four** to complementary feeding in **chapter five**. Infant growth was examined in **chapter six**, with this chapter utilising the feeding data obtained in **chapters four** and **five** to gain insight into factors associated with growth throughout the first year of life.

Ultimately, this thesis sought to identify factors, particularly *modifiable* factors, related to infant health, by assessing maternal and paternal influences on infant diet and growth. This chapter will provide a synthesis of the study findings, highlight their potential implications and make suggestions for future research.

8.2 Contribution to the literature

This research on mothers, infants and fathers has made several novel contributions to the literature on various aspects of pregnancy and the first year post-partum.

The associations between maternal wellbeing and breastfeeding outcomes were examined in **chapter four**. The findings indicated that distress was more likely at four months post-partum if a mother was breastfeeding her infant. This finding reflects the challenges faced by health services in providing adequate support to mothers beyond the early post-partum period. Improved breastfeeding support services can be easily recommended; however, the reality of implementing such a recommendation is a lengthy and arduous process (Department of Health and Children, 2005), besieged by issues with funding, staffing and the prioritisation of other more immediate and acute health needs (Coombe Women and Infants University Hospital, 2013). Although the provision of better long-term breastfeeding support services is a worthy goal, and one which health services should continue to pursue, it is important that alternative sources of informed breastfeeding support, outside of health professionals, are identified and utilised effectively. In **chapter seven**, the possibility of fathers fulfilling the role of an informed breastfeeding support was explored. Unfortunately, a substantial proportion of fathers felt unable to offer adequate technical and emotional breastfeeding support to their partner. Although many fathers wished otherwise, their lack of breastfeeding knowledge, and resulting helplessness in the face of breastfeeding challenges, may have compounded any distress experienced by their breastfeeding partner.

This research shed light on the need to include *both* parents in breastfeeding promotion, and to prepare expectant mothers *and* fathers for the physical and emotional challenges of breastfeeding. Such an approach can empower fathers to become more competent sources of breastfeeding support and may help mothers to feel more prepared and less alone in the face of breastfeeding. Future research should investigate the most effective means of promoting breastfeeding within the context of the whole family, not just mother and infant. This may help parents to become more knowledgeable and compassionate allies for each other as they embark upon their breastfeeding experience.

Examining the different dimensions of milk feeding is an important part of improving infant health outcomes. However, it is also important to investigate aspects of infant feeding beyond this period of exclusive milk feeding. Therefore, in **chapter five**, the consumption of foods other than breast milk or formula milk was assessed, as was vitamin D supplementation. Although it is positive that weaning practices continue to see improvement, a greater understanding of the maternal behaviours which underpin how infants are weaned is needed, and is a topic for consideration by future research. Additionally, the finding of poor compliance with recommended vitamin D supplementation practices for infants (Health Service Executive, 2010) highlights the need to emphasise the role of health professionals in advocating supplementation and the need to regularly monitor vitamin D supplementation, which is an important investment in long-term infant growth outcomes.

With respect to infant growth, **chapter six** investigated factors associated with growth patterns and body composition amongst healthy term infants. This study added to the existing literature (Hawkes *et al.*, 2011) on body composition at birth, and is one of the first Irish studies to investigate body composition at 12 months of age. The study found associations between maternal pre-pregnancy weight and body fat in infants at birth and between maternal smoking behaviours in pregnancy and body fat in infants at age one year. Therefore, it's clear that maternal health behaviours before the birth of an infant – and even before pregnancy – can have a profound effect on an infant's quality of growth. This is an exceptionally important observation from the point-of-view of health promotion; while every effort can be made to bring the infant feeding and supplementation practices discussed in **chapters four** and **five** in line with recommendations, these practices can only build on the foundation provided by a woman before the birth of her infant. The healthfulness of this foundation is influenced by a multitude of factors, known and unknown, which results in infant growth being a highly complex mechanism worthy of continued close scrutiny and investigation.

8.3 Study strengths and limitations

The main body of this research was a prospective observational study conducted with mothers and infants, and fathers participated by way of a cross-sectional questionnaire.

Some strengths of the study will be examined first. The prospective observational study with mothers and infants provided repeated measures on health characteristics and behaviours, and these repeated measures added to the robustness of the data obtained. Due to the lack of data on fathers' views on breastfeeding in the Irish context, a cross-sectional questionnaire was deemed the most appropriate tool to gain some insights into this topic. Furthermore, wherever possible and appropriate, validated instruments were used to obtain data and internationally accepted definitions were applied to the data obtained. Finally, one researcher conducted all measurements and was responsible for all data entry and analysis, thereby precluding the potential for any inter-observer error.

However, due to the observational nature of this study, causality cannot be determined from the data collected. Furthermore, the data collected are not nationally representative and the study populations consist only of Caucasian individuals who were overwhelmingly of either Irish or British nationality. Despite these limitations, a number of significant and noteworthy associations were established in this study which are worthy of further investigation by way of a more representative and larger study.

8.4 Recommendations for future practice

Several recommendations for practice can be made from the findings presented in this thesis.

Over a quarter of the women in this study were significantly distressed during their pregnancy. Distress in pregnancy increases the likelihood of experiencing distress in the post-partum period (Hackney *et al.*, 1996), and therefore pregnancy is an important opportunity for health services to address emotional wellbeing as women make the transition to motherhood for the first or subsequent time. Given the potential repercussions of poor maternal mental health on the wellbeing of the entire family, health services should consider routinely assessing distress amongst all pregnant women, and not just ‘high-risk’ populations. An economical and user-friendly tool, such as the Tilburg Pregnancy Distress Scale, could prove helpful in this regard, and its use within the maternity setting and at different points in pregnancy should be evaluated. Additionally, since pregnancy is a time during which both parents are often in contact with health services, it presents the opportunity to also prepare fathers for their transition to parenthood. Antenatal care may be the preserve of women; however, by recognising the needs of fathers and educating them on the needs of their partner throughout pregnancy and the post-partum period, a valuable investment can be made in the care and wellbeing of mother and infant. Therefore, as part of the care provided to pregnant women, new mothers and infants, it is important that maternity services evaluate the needs of expectant fathers and identify suitable opportunities to feasibly meet the practical and emotional needs identified.

A valuable investment can be made in the long-term bone health of infants if adherence to recommended vitamin D supplementation practices improves. Health professionals were strongly and positively associated with adherence to recommended vitamin D supplementation practices in this study, and therefore it is important that health promotion services recognise the effectiveness of advice from health professionals in this regard. Health professionals should continue to be encouraged to promote recommended vitamin D supplementation practices at routine appointments with parents and infants throughout the first year of life.

Finally, it is important that infants who demonstrate rapid growth in infancy are carefully monitored as they move into toddlerhood to ensure that their growth stabilises and returns to a healthy weight-for-length centile. A healthier growth pattern may be more likely if services are effectively coordinated to routinely monitor infant growth and to sensitively provide practical advice to parents on healthy infant feeding practices at routine appointments throughout the first year of life.

8.5 Directions for future research

Bearing in mind the contributions, strengths and limitations of this study, some directions for future research can be made.

In light of the study findings on breastfeeding from the perspective of mothers and fathers, future research should take a more holistic approach to identifying effective strategies to support breastfeeding. Intervention studies which investigate how breastfeeding education for expectant fathers impacts the emotional wellbeing of their breastfeeding partner should be considered. Such interventions could provide valuable insights into how to meaningfully include fathers in breastfeeding and into the specific emotional needs of Irish women who breastfeed beyond the early post-partum period.

Novel approaches to targeting breastfeeding through mothers could also be investigated. No intervention to date has attempted to positively influence multiple critical elements of breastfeeding simultaneously. Therefore, an intervention which aims to positively influence the following critical elements of breastfeeding could be considered: antenatal intention to breastfeed; maternal resilience; maternal self-efficacy; and maternal breastfeeding support networks. The provision of breastfeeding interventions via the Internet should also be considered.

Moving beyond breastfeeding to complementary feeding, a more detailed understanding of maternal infant feeding behaviours is needed. In order to better understand how an infant's feeding habits are established throughout the first year of life, investigation into the maternal thought processes which underpin the infant feeding strategies employed by mothers is needed. Therefore, there is a need for well-conducted qualitative research and longitudinal observational research which explore how maternal personal characteristics, parenting style and psychopathology are related to infant feeding and growth outcomes.

With respect to vitamin D supplementation in infancy, investigation into effective ways of promoting recommended supplementation practices is needed. To encourage parents to supplement their infant from the first day of life, the impact of measures such as parental education in pregnancy and reminders from health professionals during visits for vaccinations in infancy should be evaluated. The impact of asking parents to administer vitamin D to their infant during the hospital stay after birth and of providing parents with vitamin D upon leaving hospital, on long-term rates of vitamin D supplementation could also be evaluated as part of the investment into long-term bone health.

Finally, with the advent of body composition analysis in infancy, it is important that future research investigates influences on percentage body fat at birth and throughout infancy. It is also important for future research to determine the long-term health implications of percentage body fat values which fall outside of normative values in infancy. To do this, observational studies are first needed to determine normative values for percentage body fat in the latter half of infancy. Longitudinal observational studies will then be needed to identify factors which are associated with percentage body fat values which fall within, and outside of, these normative values. Thereafter, intervention studies will be needed in pregnancy or during infancy – but more likely spanning both periods – to determine the best course of action in ensuring a healthy growth pattern from the early days of life.

8.6 Conclusion

The year before, and the year after, the birth of an infant represent substantial change which affects the health and wellbeing of mother, infant and father. This thesis has contributed to our understanding of how the health behaviours of mothers, infants and fathers interact with, and influence, one another. However, there is still much to be understood about this malleable period which is so sensitive to care and insult alike, and therefore this period warrants continued close attention and investment to increase the likelihood of positive health outcomes for the whole family.

8.7 References

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Payment for taking part in the study
Your participation in the study will be acknowledged with a gift pack once the study is completed.

Who do I contact if I have any questions about this study?
If you have any questions, please contact **Annemarie Bennett**, who is the Lead Investigator for this study. Her contact details are:

Address School of Biological Sciences,
Dublin Institute of Technology,
Kevin Street,
Dublin 8.
Phone 086 069 9221
Email annemarie.bennett@dit.ie

Who supervises this study?
Dr John Kearney and Dr Margaret Sheridan-Pereira are supervising this study.

The following institutions are responsible for this study:

Coombe Women & Infants University Hospital
Excellence in the Care of Women and Babies
Foirfeacht i gCúram Ban agus Naíonán

D·I·T

Ospidéal Mhuire na Leanaí, Cromghlinn
Our Lady's Children's Hospital, Crumlin

The Baby Study

Study Information

Please read this information carefully before you make a decision on taking part in this study

What is The Baby Study?
The Baby Study hopes to monitor your baby's growth and development during their first year of life. To do this, the study will:

1. Measure your baby's weight and length,
2. Record what your baby will eat and drink, and
3. Explore your point-of-view on the different stages of feeding your baby.

How will my baby and I benefit from taking part in this study?
Your baby's progress in terms of their diet and growth will be mapped out during the study. You will receive this information to track your baby's development during the study.
You will also have the opportunity to express your views on raising a baby in Ireland today. The information you provide can be used to improve services that you and other mothers use in the future.

What will I be asked to do as part of The Baby Study?

There are four main points of contact during this part of the study.

First contact: Today

If you decide to take part today, the study will be explained and you will be asked to fill in a questionnaire. This questionnaire will ask you about your diet, lifestyle, pregnancy and household.

This will take about 15 minutes.

Second contact: Birth

Within 24 hours of you giving birth, the Lead Investigator will weigh and measure your baby while you are in hospital.

This will take about 10 minutes.

Third contact: Baby is 4 months of age

When your baby is 4 months of age, the Lead Investigator will arrange a home visit at a suitable time with you. During the visit, she will:

- Measure the weight and length of your baby
- Ask you about your experience of milk feeding your baby
- Ask you to record what your baby eats and drinks for 2 days when he or she turns 9 months of age

This visit should take about 45 minutes.

Fourth contact: Baby is 9 months of age

When your baby is 9 months of age, the Lead Investigator will arrange a home visit at a suitable time with you. During the visit, she will:

- Measure the weight and length of your baby
- Ask you about your experience of spoon-feeding your baby
- Discuss whether or not you want to take part in the study until your infant is 1 year of age

This visit should take about 45 minutes.

This leaflet only shows visits up to when my baby is 9 months of age. Doesn't the study record my baby's health until they are 1 year of age?

Yes. This study hopes to record your baby's health until they are one year of age. However, it would be difficult for mothers to plan so far ahead in terms of taking part in a study.

So, when the Lead Investigator visits you when your baby is 9 months of age, she will explain what will happen during the final visit for babies who are 1 year of age. You can decide whether to keep taking part in the study at that time.

Is there any risk to me or my baby if we take part in this study?

No. There is no risk to you or your baby during this study.

Is the information I provide to this study confidential?

Yes. All information provided will be treated confidentially. Only the Lead Investigator will have access to information you provide. You will never be identified when results are reported.

Please note that if you provide information that could result in harm to you or to another person, the appropriate professionals will be informed.

Do I have to take part in this study?

No. Taking part in this study is completely voluntary and will not affect the health services you receive.

Can I leave the study even if I decide to take part now?

Yes. You can choose to stop participating in the study at any time.

___ ___ ___ a

The Baby Study

Participant consent form

Participant declaration:

◯ This study has been explained to me.

◯ I understand what will happen as part of this study.

◯ My questions have been answered.

◯ I will never be identified when the results of the study are used.

◯ All of my information will be treated confidentially.

◯ I am free to withdraw from this study at any time.

I voluntarily agree to be part of this research study. I understand that taking part in this study will not affect my hospital care.

Signed: ____

Print name: ____

Date: ______ / ______ / __________

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Coombe Women & Infants University Hospital
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Ospidéal Mhuire na Leanaí, Cromghlinn
Our Lady's Children's Hospital, Crumlin

Lead investigator declaration:
I have explained the following in relation to this research study: nature, purpose, procedures, benefits and risks. I believe that the participant understands my explanations and has provided informed consent.

Signed: ____

Print name: Annemarie Bennett ______________________________

Date: __ __ / __ __ __ / __ __ __ __

Appendix 3

Update Excel tabs:
Overview ◯ A.N. list ◯

The Baby Study

Non-participant details

Date: _____ /__ __ __ /_______ **Study ID:** NP___ ___

Site approached: **Semi-private** ◯ **Mary Mercer** ◯ **Naas** ◯

Hospital number: ___ ___ ___ ___ ___ ___ ___ ___ ___

Name: ____

Maternal age: __ __ __ __ __ __ __ __ __, __________ years old

Parity: Primiparous ◯ Multiparous ◯

Insurance details: Private ◯ Semi-private ◯ Public ◯

Medical card: Yes ◯ No ◯

Planned pregnancy: Yes ◯ No ◯

Folic acid: None ◯ Pre-conception ◯ Post-conception ◯

EDD: ___ ___ ___ ___ ___ ___ ___ ___ ___

Baby date of birth: ___ ___ ___ ___ ___ ___ ___ ___ ___

Maternal age at birth: __ __ __ __ __ __ __ __ __, __________ years old

Gender: Male ◯ Female ◯

Gestational age: ______ + ______ weeks

Mode of delivery: Spontaneous vertex OA ◯ Ventouse ◯
Forceps ◯ Elective LSCS ◯ Emergency LSCS ◯

Birth weight: _____________ kg

Size for GA: SGA ◯ AGA ◯ LGA ◯

Feeding initiated: Exclusive breastfeeding ◯ Combination feeding ◯
Formula feeding ◯

Feeding on discharge: Exclusive breastfeeding ◯ Combination feeding ◯
Formula feeding ◯

Do you have a partner?	Yes ◯	No ◯
Are you smoking at the moment?	Yes ◯	No ◯

What is your current living situation?

Married and living with my partner	◯
Not married but living with my partner	◯
Not married and not living with my partner	◯
Single and living with my parents	◯
Single and living alone	◯
Separated	◯
Divorced	◯
Widowed	◯

What is the highest level of formal education you have completed to date?

No formal education	◯
Primary school education	◯
Secondary education	◯
Technical or vocational qualification	◯
Level 7 degree (national certificate, diploma)	◯
Level 8 degree (third level bachelor degree)	◯
Postgraduate certificate or diploma	◯
Masters	◯
Doctorate	◯

___ ___ ___ a

The Baby Study

Pregnancy questionnaire

Date: _____ / _____ / _______

Date of birth: ____ / ____ / 19 __ __

Gestational age today: ____ weeks + ____ days

What sort of questions am I going to be asked?

You will be asked questions on 3 areas:

- Your diet and lifestyle
- Your experience of this pregnancy so far
- Your household

How long will this take?

It will take 10-15 minutes to answer the questionnaire.

One last thing...

Please be honest with your answers – the information you provide is completely confidential.

SECTION 1 OF 3: YOUR DIET AND LIFESTYLE

1. **Did you take folic acid BEFORE your pregnancy was confirmed?**

Yes ◯ **No** ◯

For how long were you taking folic acid before becoming pregnant? _____ weeks

How often were you taking folic acid?

Every day ◯ 3-4 days per week ◯

1-2 days per week ◯ 5-6 days per week ◯

Do you know the name of the Folic Acid product that you were taking?

Yes, the product was ______________________________

No, I don't know the product ◯

2. **Did you take folic acid once your pregnancy was confirmed?**

◯ **I was already taking folic acid** → Go to question 3

◯ **No, I didn't take any folic acid** → Go to question 3

◯ **I started taking folic acid** → Answer the questions below

At what week of your pregnancy did you start taking folic acid? Week ____

How often were you taking folic acid?

Every day ◯ 3-4 days per week ◯

5-6 days per week ◯ 1-2 days per week ◯

Do you know the name of the Folic Acid product that you were taking?

Yes, the product was ______________________________

No, I don't know the product ◯

3. **Do you have diabetes?**

Yes, I have Type 1 diabetes ◯

Yes, I have Type 2 diabetes ◯

Yes, I have gestational diabetes (diabetes in pregnancy) ◯

No, I don't have diabetes ◯

I'm not sure – I haven't been tested for diabetes yet ◯

4. **Did you take any supplements other than folic acid <u>before</u> your pregnancy was confirmed?**

Yes ◯ **No** ◯

What was the name of this supplement or vitamin preparation?

1. ______________________________ 2. ______________________________

How often were you taking this supplement or vitamin preparation?	How often were you taking this supplement or vitamin preparation?
Every day ◯	Every day ◯
5-6 days a week ◯	5-6 days a week ◯
3-4 days a week ◯	3-4 days a week ◯
1-2 days a week ◯	1-2 days a week ◯

5. **Did you take any supplements other than folic acid once your pregnancy was confirmed?**

I took the same one above, in the same way ◯ **Yes** ◯ **No** ◯

What was the name of the supplement or vitamin preparation that you started taking?

1. ______________________________ 2. ______________________________

How many weeks were you pregnant before you started taking this supplement or vitamin preparation? ____ weeks	How many weeks were you pregnant before you started taking this supplement or vitamin preparation? ____ weeks
How often were you taking this supplement or vitamin preparation?	How often were you taking this supplement or vitamin preparation?
Every day ◯	Every day ◯
5-6 days a week ◯	5-6 days a week ◯
3-4 days a week ◯	3-4 days a week ◯
1-2 days a week ◯	1-2 days a week ◯

6. Which of these best describes how healthy your diet is?

Extremely healthy ◯

Mostly healthy ◯

Equally healthy and unhealthy ◯

Mostly unhealthy ◯

Extremely unhealthy ◯

7. Tick the statement below which describes your smoking status <u>in pregnancy</u>.

I have never smoked cigarettes ◯

I gave up smoking cigarettes BEFORE this pregnancy ◯

What age were you when you started smoking? _____ years old

What age were you when you stopped smoking? _____ years old

How many cigarettes did you usually smoke in a day? _____ cigarettes

I stopped smoking cigarettes DURING my pregnancy ◯

What age were you when you started smoking? _____ years old

In what week of your pregnancy did you stop smoking? _____ weeks

How many cigarettes did you usually smoke in a day? _____ cigarettes

I am currently smoking ◯

What age were you when you started smoking? _____years old

How many cigarettes do you currently smoke per day? _____ cigarettes

How many cigarettes did you smoke per day before your pregnancy?

Same number of cigarettes as I smoke during my pregnancy ◯

I smoked _________ cigarettes per day before my pregnancy

8. Including you, how many members of your household are smokers? ____

9. Are you on a special diet at the moment?

Yes ◯ **No** ◯

What kind of diet are you on?

Weight loss diet ◯

Vegetarian diet ◯

Vegan diet ◯

Diet for a medical condition ◯ → ____Name of condition____

Other diet ◯ → ____Name of diet____

10. Tick the statement below which best describes how you CURRENTLY drink alcohol.

Never ◯

Less than once a month ◯

1-2 times a month ◯

1 day a week ◯

2 days a week ◯

3 days a week ◯

4 days a week ◯

5 days a week ◯

6 days a week ◯

Every day ◯

On <u>each drinking occasion</u>, how many of the following would you normally drink?

Pints of beer/cider ______

Glasses of wine ______

Measures of spirits ______

Bottles of alcopops ______

11. **Choose the statement below which best describes how you drank alcohol BEFORE your pregnancy.**

Never	◯	2 days a week	◯
I drink the same amount of alcohol during pregnancy as I did before pregnancy	◯	3 days a week	◯
Less than once a month	◯	4 days a week	◯
1-2 times a month	◯	5 days a week	◯
1 day a week	◯	6 days a week	◯
		Every day	◯

On each drinking occasion, how many of the following would you normally drink?

Pints of beer/cider _______

Glasses of wine _______

Measures of spirits _______

Bottles of alcopops _______

SECTION 2 OF 3: YOUR EXPERIENCE OF YOUR PREGNANCY

The following statements relate to the way you feel about your pregnancy.

For each statement, choose how often you have felt this way <u>over the last 7 days</u>.

Over the last 7 days, I have found that...	Very often	Fairly often	Now and then	Rarely or never
I am enjoying my pregnancy				
I feel like my partner and I are enjoying the pregnancy together				
I worry about the pregnancy				
The pregnancy has brought my partner and I closer together				
I worry about the delivery				
I worry about the health of my baby				
I worry about my job once the baby is born				
I feel supported by my partner				
I worry about our financial situation after childbirth				
I am afraid I will lose self-control during delivery				
I often think about my choices concerning the delivery				
The delivery is troubling me				
I get very tense hearing stories about deliveries				
I am worried that the physical discomforts of pregnancy might continue after childbirth				
I can really share my feelings with my partner				
I worry about gaining too much weight				

The following statements relate to the way you feel about your appearance over the last FOUR WEEKS.

Tick the box that is the closest match to your answer.

Over the last 4 weeks:	**Never**	**Rarely**	**Sometimes**	**Often**	**Very often**	**Always**
Have you worried about your flesh being not firm enough?	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○
Has eating even a small amount of food made you feel fat?	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○
Have you avoided wearing clothes which make you particularly aware of the shape of your body?	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○
Have you felt ashamed of your body?	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○
Has worry about your shape made you diet?	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○
Have you felt happiest about your shape when your stomach has been empty (e.g. in the morning)?	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○
Have you felt that it is not fair that other women are thinner than you?	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○
Have you worried about your flesh being dimply?	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○

The following statements relate to the way you feel about the changes ahead of you.

Tick the number which best indicates your feelings about each statement below.

	Strongly disagree			Neutral			Strongly agree
I usually manage one way or another	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
I feel proud that I have accomplished things in life	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
I usually take things in my stride	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
I am friends with myself	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
I feel that I can handle many things at a time	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
I am determined	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
I can get through difficult times because I have experienced difficulty before	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
I have self-discipline	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
I keep interested in things	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
I can usually find something to laugh about	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
My belief in myself gets me through hard times	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
In an emergency, I am someone that people can generally rely on	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
My life has meaning	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
When I’m in a difficult situation, I can usually find my way out of it	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯

SECTION 3 OF 3: YOU AND YOUR HOUSEHOLD

12. Is this your first baby? **Yes** ◯ **No** ◯

How many other children (excluding stepchildren) do you have? _____ children

Please provide their details below.

Gender *(circle)*	Date of birth	Method of feeding *(circle)*	If *breastfed*, for how long was he or she breastfed?
Male Female	___/___/_____	Breastfed / Formula / Both	
Male Female	___/___/_____	Breastfed / Formula / Both	
Male Female	___/___/_____	Breastfed / Formula / Both	
Male Female	___/___/_____	Breastfed / Formula / Both	
Male Female	___/___/_____	Breastfed / Formula / Both	

13. How many people (including you) currently live in your home? ____ people

14. How many of these people are less than 14 years of age? ____ people

15. What was the last level of formal education you completed?

- No formal education ◯
- Primary school education ◯
- Secondary education ◯
- Technical or vocational qualification (completed apprenticeship) ◯
- Level 7 degree (national certificate, diploma) ◯
- Level 8 degree (primary degree, third level bachelor degree) ◯
- Postgraduate certificate or diploma ◯
- Masters ◯
- Doctorate ◯

16. Are you currently working outside the home?

Yes ◯ **No, I am unemployed** ◯ **No, I am a homemaker** ◯

What is your occupation? ______________________________

How many hours are you currently working per week? _____ hours

Which types of leave do you plan to take when your baby is born?

Paid maternity leave	◯	→	How many weeks?	_____ weeks
Unpaid maternity leave	◯	→	How many weeks?	_____ weeks
Annual leave	◯	→	How many weeks?	_____ weeks

Will you return to work once this leave is completed?

Yes ◯ No ◯

17. Which of the following best describes your accommodation?

Own my own home	◯
Rented from a private landlord	◯
Rented from a Local Authority	◯
Bought from a Local Authority under a Tenant Purchase Scheme	◯
Rented from a voluntary body	◯
Living with and paying rent to my parents	◯
Living free of rent with my parents	◯

18. Thinking about your household's total monthly income, how easy or difficult is it to make ends meet at the moment?

With great difficulty	◯
With difficulty	◯
With some difficulty	◯
Fairly easily	◯
Easily	◯
Very easily	◯

19. When you were about 16 years old, how easy or difficult did your household find it to make ends meet?

With great difficulty ◯

With difficulty ◯

With some difficulty ◯

Fairly easily ◯

Easily ◯

Very easily ◯

20. Please tick which (if any) of the following items you have had to do without over the last year, because of lack of money.

New (not second-hand) clothes ◯

A meal with meat or fish (or vegetarian equivalent) every other day ◯

A warm waterproof overcoat ◯

Two pairs of strong shoes ◯

A roast or its equivalent once a week ◯

Heating ◯

Keeping your home adequately warm ◯

Buying presents for family and friends once a year ◯

Replacing any worn-out furniture ◯

Having family or friends for a drink or meal once a month ◯

Having time in the last fortnight for entertaining ◯

None of these ◯

21. Can you roughly guess your weekly household income after tax? €_________

(We are asking this question to better understand levels of deprivation amongst the general population of the Coombe. This information will not be associated with your patient information.)

22. Do you have a partner?

Yes ◯ **Go to Question 23**

No ◯ **Go to Question 24**

23. If you have a partner, please answer these questions:

What is your partner's nationality? ______________________________

What is your partner's current employment status?

Currently unemployed ◯

Working part-time ◯

Working full-time ◯

What was the last level of formal education your partner completed?

No formal education ◯

Primary school education ◯

Secondary education ◯

Technical or vocational qualification ◯

Level 7 degree (national certificate, diploma) ◯

Level 8 degree (third level bachelor degree) ◯

Postgraduate certificate or diploma ◯

Masters ◯

Doctorate ◯

What is your current living situation with your partner?

Married and living with my partner ◯

Not married but living with my partner ◯

Not married and not living with my partner ◯

24. If you <u>do not</u> have a partner, please answer this question:

What is your current living situation?

Single and living with my parents ◯

Single and living alone ◯

Separated ◯

Divorced ◯

Widowed ◯

Other ◯ → ____please specify____

Thank you for completing this. We really appreciate your time and hope that you enjoy the rest of your pregnancy.

My hospital bag

Labour bag
(bring with you on admission)

- ◯ 1-page birth plan *(optional)*
- ◯ Old nightdress or T-shirt
- ◯ Thick socks or slippers
- ◯ Lip balm *(lips get very dry in labour)*
- ◯ Tissues
- ◯ Magazine
- ◯ Birthing ball *(optional)*
- ◯ TENS pain relief machine *(optional)*

Baby bag
(brought in once baby is born)

- ◯ 6 vests
- ◯ 6 long-sleeved all-in-one outfits
- ◯ 6 bibs
- ◯ Hat
- ◯ Baby gloves
- ◯ Baby towel
- ◯ Small pack of nappies *(newborn size)*
- ◯ Pack of cotton wool balls
- ◯ 2 baby blankets

Wash new and old clothes and towels before packing

Keep buttons to a minimum - snaps and zips are much easier!

After-delivery bag
(brought in once baby is born)

- ◯ Underwear
- ◯ Sanitary towels
- ◯ Breast pads *(even if not breastfeeding)*
- ◯ Nursing bra *(if breastfeeding)*
- ◯ Pyjamas with a wide-opening top
- ◯ Dressing gown
- ◯ Socks
- ◯ Slippers
- ◯ Pillow in coloured pillow-case *(optional)*
- ◯ Flip-flops for the shower
- ◯ Dark-coloured towel
- ◯ Shampoo & conditioner
- ◯ Deodorant
- ◯ Hairbrush & hairbands
- ◯ Toothbrush & toothpaste
- ◯ Face cleanser & moisturiser
- ◯ Little make-up
- ◯ Lanolin or compresses *(if breastfeeding)*
- ◯ Mini emery board *(if baby has long nails)*
- ◯ Phone charger or change for payphone
- ◯ Two black pens *(to write in your baby's chart)*
- ◯ Going-home outfit *(which fit when you were about 6 months pregnant)*

Front of the checklist given to participants for their hospital bag

Other things I need to sort...

Tips for a birth plan

- Write or type your birth plan on one A4 page in large, clear writing
- Organise the page into headings, and keep your instructions short
- Headings can include:

Who I want with me during labour *(e.g. husband, partner, mother, sister)*

The pain relief I would prefer *(e.g. epidural, TENS, massage, nothing)*

Birthing aids I plan to use *(e.g. birthing ball, birthing pool)*

The position I would prefer to be in for delivery *(e.g. on my side, on my hands and knees, whatever feels right for me at the time)*

Who I want to cut the umbilical cord *(e.g. my birthing partner, medical staff)*

If my baby and I are separated for some reason *(if you or your baby need medical attention, state whether your birthing partner should go with the baby or stay with you)*

The Baby Study

Just a little reminder that **Annemarie** will see you in hospital to get some simple measurements on your baby.

If you have questions, contact her on: 086 069 9221.

Back of the checklist given to participants for their hospital bag

The Baby Study

Participant details

Bag checklist:	Y ◯	N ◯
In calendar:	Y ◯	
Excel tabs:	Overview ◯	
	A.N. list ◯	

Date: _____ /__ __ __ /_______ **Study ID:** ___ ___ ___ a

Hospital number: ___ ___ ___ ___ ___ ___ ___ ___ ___

Site recruited: **CWIUH Semi-private** ◯ **Mary Mercer** ◯ **Naas** ◯

Name: ____

Date of birth, age: ___ ___ ___ ___ ___ ___ ___ ___ ___, __________

Mobile number: ____

Home number: ____

Address: ____

____

Insurance: Private ◯ Semi-private ◯ Public ◯

Medical card: Yes ◯ No ◯

Planned pregnancy: Yes ◯ No ◯

GA at recruitment: ______ + ______ weeks

EDD: ___ ___ ___ ___ ___ ___ ___ ___ ___

Booking-in weight: _______ kg _______ m ______kg/m^2 ___ + ___ weeks

Next-of-kin name: ____

NOK relationship: Husband ◯ Partner ◯ Mother ◯ Father ◯ Other ◯

NOK phone number: ____

NOK address: As above ◯ ________________________________

____

Date: ___ /_ _ _ /______ **Study I.D.** ___ ___ ___ a

The Baby Study

Recording of details at birth

Measured ◯ **Missed** ◯ **Refused** ◯ **Premature/NICU** ◯

Hospital number:	___ ___ ___ ___ ___ ___ ___ ___ ___
Name:	________________________________
N.O.K. name:	________________________________
N.O.K. relationship:	Husband ◯ Partner ◯ Other ◯
Maternal age at birth:	__ __ __ __ __ __ __ __ __, ________ years old
Parity:	Primiparous ◯ Multiparous ◯
Maternal Hb measured at birth:	Yes ◯ No ◯
Hb status + date of level:	__________ g/dL, _____ /__ __ __ /_______
Mode of delivery:	Spontaneous vertex OA ◯ Ventouse ◯ Forceps ◯ Elective LSCS ◯ Emergency LSCS ◯
Feeding method initiated:	Colostrum ◯ Combination feeding ◯ Formula feeding ◯
Breastfed within 1 hour:	Yes ◯ No ◯ Not applicable ◯
Feeding method on discharge:	Exclusive breastfeeding ◯ Combination feeding ◯ Formula feeding ◯
Length of hospital stay P/N:	Adm.: __ /__ D/C: __ /__ LOS: ___ hours

Follow-up at 4 months:	Yes ◯	No ◯	Not applicable ◯
Excel updated:	Overview ◯	Antenatal list ◯	Follow-up list ◯
Phone updated:	Yes ◯	Not applicable ◯	
Feedback given:	Yes ◯	Not applicable ◯	

Infant name: ________________________________

Date of birth: __ __ __ __ __ __ __ __ __

Gender: Male ◯ Female ◯

Gestational age: ______ + ______ weeks

Birth weight: _______ kg ____ lbs ____ oz ______ centile

Size for GA: SGA ◯ AGA ◯ LGA ◯

Time & date born: _________ on the _____ /__ __ __ /_______

Time & date measured: _________ on the _____ /__ __ __ /_______

Hours old at measurement: _________ hours

Head circumference: _________ cm _________ centile

Nipple: _________ cm

Chest: _________ cm

Abdomen: _________ cm

Affix chart sticker here

Mid-arm circumference: _________ cm

Mid-thigh circumference: _________ cm

Foot: _________ cm

Length: _________ cm _________ centile

Weight by pea-pod: _________ kg _________ centile (__lbs __oz)

FFM (%): _________ %

FFM (kg): _________ kg

Body fat (%): _________ % → **Maternal GDM:** Y ◯ N ◯

Body fat (kg): _________ kg

Babies are such a nice way to start people.

- Don Herold

The Baby Study

Front of the feedback card given to mothers on their infant's birth measures

Name: ______________________________

Birth weight: _______ kg or _____ lbs _____ oz

Born: _______ on ______ of __________ _____

Measured: _______ on ______ of __________ _____

Hours old at measurement: _______ hours old

Physical measurements

Head circumference	________	cm
Mid-arm circumference	________	cm
Chest	________	cm
Tummy	________	cm
Mid-thigh circumference	________	cm
Foot	________	cm
Length	________	cm

Weight measurements

Total weight	________ kg	or	_____	lbs	_____	oz
Weight that is fat	________ kg	or	_____	lbs	_____	oz
Weight that is fat-free	________ kg	or	_____	lbs	_____	oz
% fat	________ %					
% fat-free	________ %					

What do these measurements mean?

Back of the feedback card given to mothers on their infant's birth measures

___ ___ ___ a

The Baby Study

Consent form for home visit

Participant declaration:

◯ I understand that during this visit I will be asked about me and my baby.

◯ My questions about this visit have been answered.

◯ I will never be identified when the results of the study are used.

◯ All information I provide is strictly confidential.

◯ I am free to end this home visit at any time.

I voluntarily agree to be part of this study. I understand that taking part in this study will not affect my hospital care.

Signed: ____

Print name: ____

Date: ______ / ______ / __________

DIT — Coombe Women & Infants University Hospital — Our Lady's Children's Hospital, Crumlin

Lead investigator declaration:
I have explained the following in relation to this home visit: nature, purpose, and procedures. I believe that the participant understands my explanations and has provided informed consent.

Signed: ____

Print name: Annemarie Bennett______________________________

Date: __ __ / __ __ __ / __ __ __ __

Study I.D. ___ ___ ___ a

The Baby Study

Recording of details at 4 month post-partum

Date: __ __/__ __ __/__ __ __ __

Name: ________________________________

Parity: Primiparous ◯ Multiparous ◯

Feeding method initiated: Breastfeeding ◯ Formula feeding ◯

Feeding method on discharge: Exclusive breastfeeding ◯ Combination ◯ Formula feeding ◯

N.O.K. name: ________________________________

N.O.K. relationship: Husband ◯ Partner ◯ Other ◯

Address: ________________________________

____

Notes on visit: ________________________________

Follow-up: Yes ◯ No ◯

Holidays at follow-up: Yes, ________________ None ◯

Help with house address: In Satnav, no issues ◯

Directions:

____

____

____

____

Excel updated: Overview ◯ Follow-up list ◯

Phone updated: Yes ◯ Not applicable ◯

Measurements letter posted: Yes ◯ Not applicable ◯

Left a Dad Questionnaire: Yes ◯ No ◯ Not applicable ◯

Infant name: ________________________________

Date of birth: __ __ __ __ __ __ __ __ __

Gender: Male ◯ Female ◯

Age at follow-up: ______ + ______ weeks

Birth weight: ________ kg ____ lbs ____ oz

Head circumference: _________ cm _________ centile

Nipple: _________ cm

Chest: _________ cm

Abdomen: _________ cm

Mid-arm circumference: _________ cm

Mid-thigh circumference: _________ cm

Foot: _________ cm

Length: _________ cm _________ centile

Weight: _________ kg _________ centile

____ lbs ____ oz

____ / __ __ __ /_______ ___ ___ ___ a

The Baby Study

4-month post-partum questionnaire

What sort of questions am I going to be asked?

You will be asked questions on 4 areas:

- Milk feeding your baby
- Supplementation and your baby
- Spoon-feeding your baby
- Support with taking care of your baby

How long will this take?

It will take about 10 minutes to answer this questionnaire.

SECTION 1: MILK FEEDING

1. **Have you received any leaflets or samples from an infant feeding company?**

   Yes ◯ No ◯

   Skip to question 3

2. **What company (or companies) sent you information?**

   SMA ◯ Hipp Organic ◯

   Aptamil ◯ Other ___name company___ ◯

   Cow and Gate ◯

3. **Were you breastfed as a baby?**

   Yes ◯ No ◯ I don't know ◯

4. **Did your baby ever receive breast milk?**

   Yes ◯ No ◯

   Skip to question 22, page 7

5. **<u>Before</u> your baby was born, had you put any supports in place to help you to breastfeed?** *Supports include visiting local breastfeeding support groups during pregnancy or asking family members to help with housework once the baby was born.*

   Yes, I had supports in place to help me to breastfeed ◯

   No, I didn't put specific supports in place ◯

6. **Did your partner support you breastfeeding?**

   Yes, my partner supported me completely ◯

   Yes, my partner supported me, but found some aspects of breastfeeding difficult ◯

   No, my partner was not supportive of me breastfeeding ◯

7. **Roughly how much time did a midwife or lactation consultant spend helping you to breastfeed in hospital?**

_____ minutes OR _____ hours

8. **Who helped you to establish breastfeeding?**

Midwife	◯
Lactation consultant	◯
Mother	◯
Sister	◯
Friend	◯
No-one offered assistance	◯
I didn't need help with establishing breastfeeding	◯

9. **Who or what was your main source of information on breastfeeding?**

Midwife		◯
Lactation consultant		◯
Public Health Nurse		◯
Breastfeeding leaflets		◯
Breastfeeding Support Group (e.g. La Leche League)		◯
Internet		◯
Family member	____name this person, e.g. mother____	◯
Other	________name this source________	◯

10. **Have you expressed any breast milk?**

Yes ◯ No ◯

Skip to question 13

11. How do you express your breast milk?

- By hand ◯
- Using a hand pump ◯
- Using an electric pump ◯

12. What is your main reason for expressing breast milk?

- My return to work ◯
- In order to share responsibility for feeding ◯
- Baby was not suckling well at the breast ◯
- To help maintain my milk supply ◯
- Other ________________please give reason________________ ◯

13. Did you breastfeed once you left hospital?

Yes ◯ No ◯

What was your main reason for deciding to stop breastfeeding at this time?

____

____

Thinking back, did you expect that breastfeeding would be as challenging as it was?

- Yes, I expected the challenges I had with breastfeeding ◯
- No, I did not expect the challenges I had with breastfeeding ◯
- I didn't have any challenges with breastfeeding ◯

Go to QUESTION 21 on page 7

14. Have you breastfed in public since having this baby?

Yes ◯

How would you describe the experience?

- Very positive ◯
- Mostly positive ◯
- Neither positive nor negative ◯
- Mostly negative ◯
- Very negative ◯

Do you have any comments to make on your experience of breastfeeding in public?

____

____

No ◯

Is there any particular reason why?

- Have never needed to breastfeed in public ◯
- Lack of facilities ◯
- Feel self-conscious breastfeeding in public ◯
- Other ___________give reason__________ ◯

Do you plan to ever breastfeed in public?

Yes ◯ No ◯

15. Have you had any difficulties with breastfeeding?

Yes ◯

No ◯

Skip to question 18

16. What difficulties have you had? *(tick all that apply)*

- Mastitis ◯
- Thrush ◯
- Engorgement ◯
- Latching difficulties ◯
- Clogged milk ducts ◯
- Baby sleeping at breast ◯
- Sore or cracked nipples ◯
- Other: ______name difficulty______ ◯

17. Have you managed to solve these difficulties?

Yes ◯ No ◯

How did you solve your difficulties?

____

____

18. Did you expect that breastfeeding would be as challenging as it was?

Yes, I expected the challenges I had with breastfeeding ◯

No, I did not expect the challenges I had with breastfeeding ◯

I didn't have any challenges with breastfeeding ◯

19. Are you breastfeeding at the moment?

Yes, I am breastfeeding and formula feeding ◯ → *Go to question 20, below*

No, I am formula feeding my baby ◯ → *Skip to question 21, page 7*

Yes, I am exclusively breastfeeding ◯ → *Skip to question 23, page 8*

20.

a. What is your main reason for choosing to both formula-feed and breastfeed?

____

b. What age was your baby when you first introduced formula milk? ________

c. Has your baby had any difficulty getting used to the two methods of feeding?

Yes ◯ No ◯

d. How many breastfeeds does your baby normally take in 24 hours? ________

e. How many formula feeds does your baby take in 24 hours? ________

f. Roughly how much formula milk does your baby drink at each feed? ______ oz

Skip to QUESTION 23 on page 8

21. For how long did you breastfeed: **Exclusively?** ______________

Altogether? ______________

22.

a. What formula milk are you using at the moment? ______________________

b. Have you tried other formula milks?

Yes ◯ No ◯

What other formula milks have you tried?

____

What was your main reason for changing milk formulas?

____

c. Have you gotten any advice on formula feeding from a healthcare professional?

Yes ◯ No ◯

d. Who or what has been your main source of advice on formula feeding?

My own past experience with formula feeding ◯
Midwife in hospital ◯
Public Health Nurse ◯
Formula feeding leaflets ◯
Family ◯
Friend ◯
Internet ◯
Other ______name this source______ ◯

e. How many feeds of formula milk is your baby taking in a full 24 hours? _______

f. About how much formula milk does your baby drink at each feed? _______

g. Do you add anything extra to your baby's formula milk?

Yes ◯ No ◯

What do you add to your baby's formula milk?

____

h. What aspect of formula feeding suits you best, if any?

____

SECTION 2: SUPPLEMENTATION PRACTICES

23. Are YOU taking any supplements or vitamin preparations?

Yes ◯ No ◯

Skip to question 26

24. What is the name of this supplement or vitamin preparation?

1. ______________________________

How often are you taking this supplement or vitamin preparation?

Every day ◯ 5-6 days a week ◯

3-4 days a week ◯ 1-2 days a week ◯

2. ______________________________

How often are you taking this supplement or vitamin preparation?

Every day ◯ 5-6 days a week ◯

3-4 days a week ◯ 1-2 days a week ◯

25. Why have you decided to take this/these supplement(s) or vitamin drops?

Advised by my midwife ◯

Advised by my Public Health Nurse ◯

Advised by my GP ◯

Read it on the internet ◯

Read it in a book ◯

Advised by a family member ◯

Advised by a friend ◯

Other ◯

26. Are you giving your baby any supplements or vitamin drops?

Yes ◯

Skip to **question 28**

No ◯

Go to **question 27**

27. Has any healthcare professional given you information about supplement or vitamin drops for babies?

Yes ◯

What supplement or vitamin drop did they provide you with information on?

1. ________________________________

2. ________________________________

Go to QUESTION 30 on page 10

No ◯

Skip to question 30 on page 10

28. Please name the supplements or vitamin drops you are giving your baby at the moment.

1. ____________________________

How often are you taking this supplement or vitamin preparation?

Every day ◯ 5-6 days a week ◯

3-4 days a week ◯ 1-2 days a week ◯

2. ____________________________

How often are you taking this supplement or vitamin preparation?

Every day ◯ 5-6 days a week ◯

3-4 days a week ◯ 1-2 days a week ◯

29. Why are you giving your baby these supplements or vitamin drops?

Advised by my midwife ◯

Advised by my Public Health Nurse ◯

Advised by my GP ◯

Read it on the internet ◯

Read it in a book ◯

Advised by a family member ◯

Advised by a friend ◯

Saw the product advertised ◯

Other ______please give reason______ ◯

SECTION 3: SPOON-FEEDING

30. Have you introduced any spoon feeds to your baby?

Yes ◯ No ◯

Skip to question 36 on page 11

31. When did you introduce these spoon feeds? Baby was ______ weeks old

32. What was your main reason for introducing spoon feeds at this time?

____

33. What was the first food you fed your baby?

Baby rice ◯

Fruit ◯

Vegetables ◯

Other __________please name this food__________ ◯

34. How many meals is your baby taking during the day? ______ meals

35. Did anyone help you to make the decision about introducing spoon feeds to your baby?

Yes ◯ No ◯

Who made this decision with you?

Partner ◯

Mother ◯

Mother-in-law ◯

Friend ◯

Healthcare professional ◯

Other ______name this person______ ◯

36. Did you receive any advice from a healthcare professional about introducing spoon feeds to your baby?

Yes ◯ No ◯

Skip to question 38 below

37. What advice did you receive about weaning your baby?

____

38. Does your baby drink any fluids other than plain water or milk at the moment?

Yes ◯ No ◯

Skip to question 40

39. What fluids other than milk and water does your baby drink? *(tick all that apply)*

Baby juice ◯
Regular juice ◯
Fizzy water ◯
Fizzy drinks ◯
Tea ◯
Other ____________please name this drink____________ ◯

40. Does your baby use a soother?

Yes ◯ No ◯

Skip to question 42 on page 12

41. What age was your baby when the soother was introduced?

Used a soother from birth ◯

Used a soother from age ______ weeks ◯

SECTION 4: JUST YOU

42. Are you smoking at the moment?

Yes ◯

No ◯

Skip to question 44

43. How many cigarettes do you usually smoke each day? ________ cigarettes

44. Tick the statement below which best describes how you CURRENTLY drink alcohol.

Never	◯	3 days a week	◯
Less than once a month	◯	4 days a week	◯
1-2 times a month	◯	5 days a week	◯
1 day a week	◯	6 days a week	◯
2 days a week	◯	Every day	◯

On <u>each drinking occasion</u>, how many of the following would you normally drink?

Pints of beer/cider _______

Glasses of wine _______

Measures of spirits _______

Bottles of alcopops _______

The following statements relate to the way you feel about your life at the moment.

Tick the box that is the closest match to your answer.

	Strongly disagree			Neutral			Strongly agree
I usually manage one way or another	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
I feel proud that I have accomplished things in life	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
I usually take things in my stride	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
I am friends with myself	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
I feel that I can handle many things at a time	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
I am determined	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
I can get through difficult times because I have experienced difficulty before	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
I have self-discipline	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
I keep interested in things	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
I can usually find something to laugh about	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
My belief in myself gets me through hard times	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
In an emergency, I am someone that people can generally rely on	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
My life has meaning	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯
When I'm in a difficult situation, I can usually find my way out of it	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯	7 ◯

The following questions relate to the way you feel about the changes that often occur with a new baby.

Tick the box that best describes how you have felt OVER THE LAST MONTH.

	Always	Most of the time	Occasionally	Not often	Never
I find playing with my child an easy activity					
My child can easily cheer me up					
I find looking after my child a strain at times					
I know when my child needs me					
I can interpret my child's cries, such as hunger, tiredness, etc.					
I find my child easy to feed					
I find that my child's sleeping habits pose problems					
I find it easy to keep my child in a routine					
I find that outings with my child cause me some difficulty					
When I need to go out, I feel comfortable leaving my child with someone else					

The following statements relate to the way you feel about your appearance over the last FOUR WEEKS.

Tick the box that is the closest match to your answer.

Over the LAST 4 WEEKS:	**Never**	**Rarely**	**Sometimes**	**Often**	**Very often**	**Always**
Have you worried about your flesh being not firm enough?	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯
Has eating even a small amount of food made you feel fat?	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯
Have you avoided wearing clothes which make you particularly aware of the shape of your body?	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯
Have you felt ashamed of your body?	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯
Has worry about your shape made you diet?	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯
Have you felt happiest about your shape when your stomach has been empty (e.g. in the morning)?	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯
Have you felt that it is not fair that other women are thinner than you?	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯
Have you worried about your flesh being dimply?	1 ◯	2 ◯	3 ◯	4 ◯	5 ◯	6 ◯

45. Who have been the 2 most important people in your social network in the last 4 months?

- My partner ◯
- My mother ◯
- My mother-in-law ◯
- My father ◯
- My sister ◯
- A friend ◯
- Mothers in support groups ◯
- Other ____________name this person____________ ◯

46. What 2 people best help you to cope with the challenges you experience with the new baby?

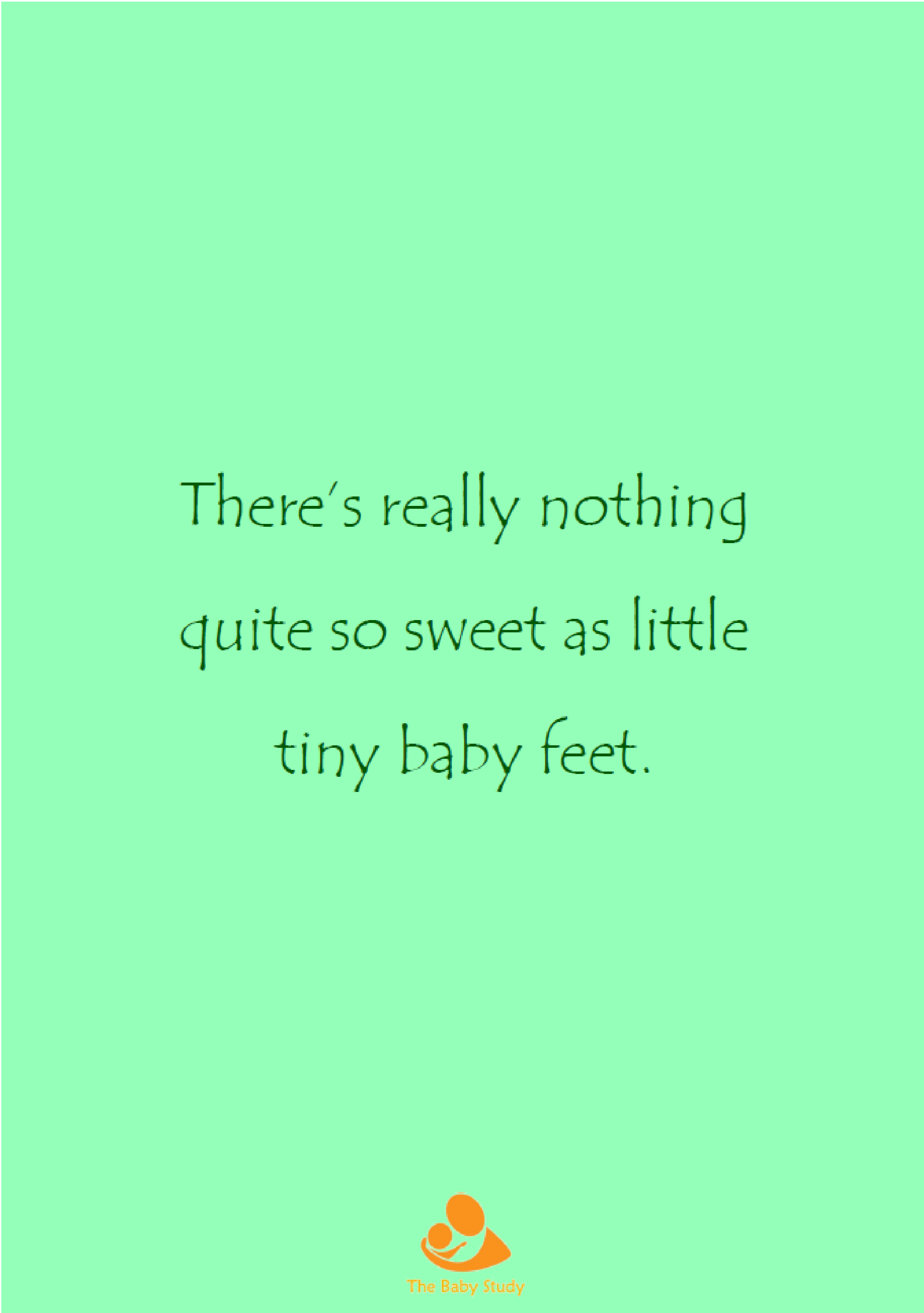
- My partner ◯
- My mother ◯
- My mother-in-law ◯
- My father ◯
- My sister ◯
- A friend ◯
- Mothers in support groups ◯
- Other ____________name this person____________ ◯

47. What sort of help do you find to be the most useful? *E.g. help with cooking and cleaning, someone coming in for a chat, etc.*

____

____

Thanks so much **for taking the time to complete this questionnaire – we really do appreciate it.**



Front of the feedback card on the measurements of four-month-old infants

Name: ____

Measured on: ______ ____________________ _________

Age at measurement: ______ weeks old

Physical measurements

Head circumference ____________ cm

Mid-arm circumference ____________ cm

Chest ____________ cm

Tummy ____________ cm

Mid-thigh circumference ____________ cm

Foot ____________ cm

Length ____________ cm

Weight measurements

Total weight ___________ kg or ______ lbs ______ oz

How I've grown so far

My birth weight was ____

Today my weight is ____

My birth length was ____

Today my length is ____

What do these measurements mean?

____

____

____

____

Back of the feedback card on the measurements of four-month-old infants

Appendix 13

Study I.D. __ __ __ a

The Baby Study

Recording of details at 9 months

Date:	__ __/__ __ __/__ __ __ __
Name:	______________________________
Parity:	Primiparous ◯ Multiparous ◯
Feeding method at 4 months:	Exclusive breastfeeding ◯ Combination ◯ Formula feeding ◯
Notes on feeding:	______________________________
N.O.K. name:	______________________________
N.O.K. relationship:	Husband ◯ Partner ◯ Other ◯
Address:	______________________________ ______________________________

Notes on visit:

____

____

Follow-up:	Yes ◯	No ◯
Holidays at follow-up:	Yes, ________________	None ◯
Help with house address:	In Satnav, no issues ◯ Directions: ______________________________ ______________________________ ______________________________	
Excel updated:	Overview ◯	Follow-up list ◯
Phone updated:	Yes ◯	Not applicable ◯
Measurements letter posted:	Yes ◯	Not applicable ◯

Infant name: ________________________________

Date of birth: __ __ __ __ __ __ __ __ __

Gender: Male ◯ Female ◯

Age at follow-up: ____ months & ____ days

Age crawled: ________________________

Head circumference: _________ cm _________ centile

Nipple: _________ cm

Chest: _________ cm

Abdomen: _________ cm

Mid-arm circumference: _________ cm

Mid-thigh circumference: _________ cm

Foot: _________ cm

Length: _________ cm _________ centile

Weight: _________ kg _________ centile

____ lbs ____ oz

____ / __ __ __ /_______ ___ ___ ___ a

The Baby Study

9-month post-partum questionnaire

What sort of questions am I going to be asked?

You will be asked questions on 4 areas:

- Milk feeding your baby
- Spoon-feeding your baby
- Supplementation and your baby
- A couple of things on you

How long will this take?

It will take about 5 minutes to answer this questionnaire.

SECTION 1: MILK FEEDING YOUR BABY

1. **Which statement below best describes how you are MILK FEEDING your baby right now?**

   I am giving my baby breast milk & formula milk ◯ ⟶ **Go to question 2 below**

   I am giving my baby breast milk only ◯ ⟶ **Skip to question 14**

   I am giving my baby formula milk only ◯ ⟶ **Go to question 2 below**

2. **When did you first introduce formula milk?**

   I introduced formula milk from birth ◯ **Skip to question 11**

   I introduced formula before my baby was 17 weeks old ◯ **Skip to question 11**

   I introduced formula after my baby turned 17 weeks old ◯ **Go to question 3**

3. **How many weeks did you exclusively breastfeed your baby for?** ___________

4. **For how many weeks did you breastfeed (exclusive and combination feeding together) your baby overall?** ________________

5. **How many weeks in total did you breastfeed (exclusive and combination feeding?** ________________

6. **What was your main reason for deciding to stop or reduce breastfeeding?**

   ____

7. **What formula milk are you using at the moment?** ________________________

8. **Have you tried other formula milks?** Yes ◯ No ◯

   Skip to **question 10**

9. **What other formula milks have you tried?**

   ____

10. What was your main reason for changing milk formulas?

____

11. Have you gotten any advice on formula feeding from a healthcare professional?

Yes ◯ No ◯

Skip to **question 12** on this page

Skip to **question 12** below

12. What formula milk are you using at the moment? ________________________

13. How many feeds of formula milk is your baby taking in 24 hours? ______

14. Roughly how much formula milk does your baby drink at each feed? ______

SECTION 2: SPOON-FEEDING

15. Have you introduced any food other than breast or formula milk to your baby? Yes ◯ No ◯

Skip to **question 27** on page 6

16. What age was your baby when you introduced this food? _______________

17. What was the first food you fed your baby?

Baby rice ◯

Fruit ◯

Vegetables ◯

Other __________please name this food__________ ◯

18. How many meals is your baby taking during the day? ______

19. How would you describe the texture of the foods your baby MOSTLY eats right now?

Puréed and runny ◯

Soft and smooth ◯

Soft and lumpy ◯

Mashed and minced ◯

Roughly chopped ◯

Finger foods ◯

20. How much of the time do you use a spoon to feed your baby?

100% ◯

90% ◯

75% ◯

50% ◯

25% ◯

10% ◯

0% ◯

21. How much of the time would your baby eat puréed food?

- 100% ◯
- 90% ◯
- 75% ◯
- 50% ◯
- 25% ◯
- 10% ◯
- 0% ◯

22. Does your baby eat any snacks?

Yes ◯ No ◯

Skip to **question 23** below

23. What kind of snacks does your baby normally eat?

Baby chocolate	◯	Standard yogurt	◯
Standard chocolate	◯	Baby biscuits	◯
Bread & butter	◯	Rice cakes	◯
Bread & jam	◯	Standard biscuits	◯
Standard crisps	◯	Fruit	◯
Baby crisps	◯	Vegetables	◯
Ice-cream	◯	Cheese	◯
Infant rusks	◯		
Baby yogurt	◯	Other __name snack(s)__	◯

24. Have you introduced meat into your baby's diet yet?

Yes ◯ No ◯

Skip to **question 26** on the next page

25. What meats have you introduced?

Beef	◯	Turkey	◯
Lamb	◯	Ham	◯
Chicken	◯	Other __name meat(s)__	◯

26. What age was your baby when you first introduced meat? __________

27. Tick which of the following you include in your baby's meals.

- Butter ◯
- Salt ◯
- Sugar ◯
- Gravy ◯
- Stock ◯
- Sauce ◯
- None of these ◯

28. Does your baby have any <u>diagnosed</u> food allergies?

Yes ◯ No ◯

Skip to **question 29** below

29. What allergy or allergies has your baby been diagnosed with?

____

30. Does your baby drink any fluids other than plain water, breast milk or formula milk at the moment?

Yes ◯ No ◯

Go to **question 31** on the next page

31. What fluids other than milk and water does your baby drink?

- Cow's milk ◯
- Baby juice ◯
- Regular juice ◯
- Diluted fruit drink ◯
- Fizzy water ◯
- Fizzy drinks ◯
- Tea ◯
- Other ___name this drink___ ◯

SECTION 3: SUPPLEMENTATION AND YOUR BABY

32. Are YOU taking any supplements or vitamin preparations?

Yes ◯ No ◯

Skip to **question 33** below

33. What is the name of this supplement or vitamin preparation?

1. ______________________________

How often are you taking this supplement or vitamin preparation?

Every day ◯ 5-6 days a week ◯

3-4 days a week ◯ 1-2 days a week ◯

2. ______________________________

How often are you taking this supplement or vitamin preparation?

Every day ◯ 5-6 days a week ◯

3-4 days a week ◯ 1-2 days a week ◯

34. Are you giving your baby any supplements or vitamin drops?

Yes ◯ No ◯

Skip to **question 35** on the next page

35. Please name the supplements or vitamin drops you are giving your baby at the moment.

1. ______________________________

How often are you taking this supplement or vitamin preparation?

Every day ◯ 5-6 days a week ◯

3-4 days a week ◯ 1-2 days a week ◯

2. ______________________________

How often are you taking this supplement or vitamin preparation?

Every day ◯ 5-6 days a week ◯

3-4 days a week ◯ 1-2 days a week ◯

SECTION 4: A COUPLE OF THINGS ON YOU

36. Are you smoking at the moment?

Yes ◯ No ◯

Skip to **question 37** below

37. How many cigarettes do you usually smoke each day? ________ cigarettes

38. Tick the statement below which best describes how you CURRENTLY drink alcohol.

Never	◯	3 days a week	◯
Less than once a month	◯	4 days a week	◯
1-2 times a month	◯	5 days a week	◯
1 day a week	◯	6 days a week	◯
2 days a week	◯	Every day	◯

On EACH *drinking occasion*, how many of the following would you normally drink?

Pints of beer/cider	______	Measures of spirits	______
Glasses of wine	______	Bottles of alcopops	______

Thank you for answering this.

Your time is always appreciated.

Front of the feedback card on the measurements of nine-month-old boys

Name: ______________________________

Measured on: _____ ______________ _______

Age at measurement: _____ months old

Physical measurements

Head circumference	__________ cm
Mid-arm circumference	__________ cm
Chest	__________ cm
Tummy	__________ cm
Mid-thigh circumference	__________ cm
Foot	__________ cm
Length	__________ cm

Weight measurements

Total weight _________ kg or ______ lbs ______ oz

How have I been doing so far?

____

____

____

____

____

____

____

____

Back of the feedback card on the measurements of nine-month-old boys

Front of the feedback card on the measurements of nine-month-old girls

Name: ______________________________

Measured on: _____ ______________ _______

Age at measurement: _____ months old

Physical measurements

Head circumference	__________ cm
Mid-arm circumference	__________ cm
Chest	__________ cm
Tummy	__________ cm
Mid-thigh circumference	__________ cm
Foot	__________ cm
Length	__________ cm

Weight measurements

Total weight __________ kg or ______ lbs ______ oz

How have I been doing so far?

Back of the feedback card on the measurements of nine-month-old girls

Date: ___ /_ _ _ /_____

The Baby Study

Study I.D. ___ ___ ___ a

Recording of details at 12 months

Name: ________________________________

N.O.K. name: ________________________________

N.O.K. relationship: Husband ◯ Partner ◯ Other ◯

Address: ________________________________

____

Milk feeding method at 9 months:

Breast milk ◯ Breast and formula milk ◯ Formula milk ◯

Main milk drink at 12 months:

Breast milk only	◯		
Breast milk and formula milk	◯	Age AF started if introduced after 9mo	_____
Formula milk	◯	Age BF ceased if ceased after 9mo	_____
Cow milk	◯	Age of introduction	_____

Intend to introduce cow milk before 13 months? Yes ◯ No ◯ Not applicable ◯

Number of feeds in 24 hours: _______ feeds

Volume of milk at each feed: _______ mls / oz.

Do you use a free-flow or lidless Sippy cup? Yes ◯ No ◯

Sleep patterns during the day: ________________________________

Sleep patterns during the night: ________________________________

Excel updated:	Overview	◯	Follow-up list	◯
Phone updated:	Yes	◯	Not applicable	◯
Final letter posted:	Yes	◯	Not applicable	◯

Infant name: ________________________________

Date of birth: __ __ __ __ __ __ __ __ __ _

Gender: Male ◯ Female ◯

%BF at birth: ______

Age at follow-up: ______ + ______ months

Crawled: ______ months

Walked: ______ months

Head circumference: _________ cm _________ centile

Nipple: _________ cm

Chest: _________ cm

Abdomen: _________ cm

Mid-arm circumference: _________ cm

Mid-thigh circumference: _________ cm

Foot: _________ cm

Length: _________ cm _________ centile

Weight: _________ kg _________ centile

____ lbs ____ oz

ImpediMed measure: Yes ◯ No ◯

Appendix 17

____ / __ __ __ /_______ ___ ___ ___ a

The Baby Study

12-month post-partum questionnaire

What sort of questions am I going to be asked?

You will be asked questions on 3 areas:

- Your baby's diet
- Supplementation and your baby
- Support with taking care of your baby

How long will this take?

It will take 5-10 minutes to answer this questionnaire.

SECTION 1: YOUR BABY'S DIET

1. **How many meals is your baby taking during the day?** _____ meals

2. **How would you describe the texture of the foods your baby MOSTLY eats right now?**

   Puréed and runny ◯
   Soft and smooth ◯
   Soft and lumpy ◯
   Mashed and minced ◯
   Roughly chopped ◯
   Finger foods ◯

3. **How many snacks is your baby taking during the day?** _____ snacks

4. **Tick which, if any, of the snacks below your baby would eat more than once a week.**

Infant rusks	◯	Crackers	◯
Baby yogurt	◯	Baby chocolate	◯
Standard yogurt	◯	Standard chocolate	◯
Baby biscuits	◯	Bread & butter	◯
Standard biscuits	◯	Bread & jam	◯
Fruit	◯	Crisps	◯
Vegetables	◯	Ice-cream	◯
Cheese	◯	Other ____name snack(s)____	◯

5. **Does your baby drink any fluids other than plain water, breast milk or formula milk at the moment?**

   Yes ◯ No ◯

   Go to **question 7** on the next page

6. **What fluids other than milk and water does your baby drink?**

Cow's milk	◯	Fizzy water	◯
Baby juice	◯	Fizzy drinks	◯
Regular juice	◯	Tea	◯
Diluted fruit drink	◯	Other __name this drink__	◯

7. **Would you say that your baby is eating 'family meals' now?**

Yes ◯ No ◯

8. **Thinking back over the year of feeding your baby, what part did you have the most questions about?** E.g. breastfeeding, starting weaning, progressing from purées to more solid foods, etc.

____

9. **Does your baby have any <u>diagnosed</u> food allergies?**

Yes ◯ No ◯

Skip to the next page

10. **What allergy or allergies has your baby been diagnosed with?**

____

The following statements are about feeding your baby.

Tick the box that is the closest match to your answer.

	Never	Seldom	Half the time	Most of the time	Always
When your child is at home, how often are you responsible for feeding her?	◯	◯	◯	◯	◯
How often are you responsible for deciding what your child's portion sizes are?	◯	◯	◯	◯	◯
How often are you responsible for deciding if your child has eaten the right kind of foods?	◯	◯	◯	◯	◯

	Unconcerned	A little concerned	Concerned	Fairly concerned	Very concerned
How concerned are you about your child eating too much when you are not around her?	◯	◯	◯	◯	◯
How concerned are you about your child maintaining a desirable weight?	◯	◯	◯	◯	◯
How concerned are you about your child becoming overweight?	◯	◯	◯	◯	◯

	Disagree	Slightly disagree	Neutral	Slightly agree	Agree
I have to be sure that my child does not eat too many sweet foods.	◯	◯	◯	◯	◯
I have to be sure that my child does not eat too many high-fat foods.	◯	◯	◯	◯	◯
I have to be sure that my child does not eat too much of her favourite foods.	◯	◯	◯	◯	◯
If I did not guide my child's eating, she would eat too much of her favourite foods.	◯	◯	◯	◯	◯
My child should always eat all of the food on her plate.	◯	◯	◯	◯	◯
I have to be especially careful to make sure my child eats enough.	◯	◯	◯	◯	◯
If my child is not hungry I try to get her to eat anyway.	◯	◯	◯	◯	◯
If I did not guide my child's eating, she would eat much less than she should.	◯	◯	◯	◯	◯

	Never	Rarely	Sometimes	Mostly	Always
How much do you keep track of the sweet foods your child eats?	○	○	○	○	○
How much do you keep track of the snack foods your child eats?	○	○	○	○	○
How much do you keep track of the high-fat foods your child eats?	○	○	○	○	○

	Underweight	Normal	Overweight
How would you describe your weight during your childhood?	○	○	○
How would you describe your weight during your adolescence?	○	○	○
How would you describe your weight at present?	○	○	○

The following statements relate to the way you feel about your appearance over the last FOUR WEEKS.

Tick the box that is the closest match to your answer.

Over the LAST 4 WEEKS:	**Never**	**Rarely**	**Sometimes**	**Often**	**Very often**	**Always**
Have you worried about your flesh being not firm enough?	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○
Has eating even a small amount of food made you feel fat?	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○
Have you avoided wearing clothes which make you particularly aware of the shape of your body?	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○
Have you felt ashamed of your body?	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○
Has worry about your shape made you diet?	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○
Have you felt happiest about your shape when your stomach has been empty (e.g. in the morning)?	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○
Have you felt that it is not fair that other women are thinner than you?	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○
Have you worried about your flesh being dimply?	1 ○	2 ○	3 ○	4 ○	5 ○	6 ○

SECTION 2: SUPPLEMENTATION FOR YOU AND YOUR BABY

11. Are YOU taking any supplements or vitamin preparations?

Yes ◯ No ◯

Skip to **question 13** below

12. What is the name of this supplement or vitamin preparation?

1. ______________________________

How often are you taking this supplement or vitamin preparation?	
Every day ◯	5-6 days a week ◯
3-4 days a week ◯	1-2 days a week ◯

2. ______________________________

How often are you taking this supplement or vitamin preparation?	
Every day ◯	5-6 days a week ◯
3-4 days a week ◯	1-2 days a week ◯

13. Are you giving your baby any supplements or vitamin drops?

Yes ◯ No ◯

Skip to **question 15** on the next page

14. Please name the supplements or vitamin drops you are giving your baby at the moment.

1. ______________________________

How often are you taking this supplement or vitamin preparation?	
Every day ◯	5-6 days a week ◯
3-4 days a week ◯	1-2 days a week ◯

2. ______________________________

How often are you taking this supplement or vitamin preparation?	
Every day ◯	5-6 days a week ◯
3-4 days a week ◯	1-2 days a week ◯

SECTION 3: A FEW THINGS ON YOU AND YOUR BABY AT THE MOMENT

15. Does your baby attend a crèche or child-minder (including grandparents)?

Yes ◯ No ◯

Skip to **question 19** below

16. Does your baby attend the crèche or child-minder full-time or part-time?

Full-time ◯ Part-time ◯

How many **hours** do they spend with the crèche or child-minder?

____

17. At what age did they first attend the crèche or child-minder? _____ months old

18. Who provides your baby's meals when they are in the crèche or at the child-minder?

I provide my baby's meals ◯

My baby's meals are provided by the crèche or child-minder ◯

19. Are you smoking at the moment?

Yes ◯ No ◯

Skip to **question 21** on the next page

20. How many cigarettes do you usually smoke each day? _______ cigarettes

21. Tick the statement below which best describes how you CURRENTLY drink alcohol.

Never	◯	3 days a week	◯
Less than once a month	◯	4 days a week	◯
1-2 times a month	◯	5 days a week	◯
1 day a week	◯	6 days a week	◯
2 days a week	◯	Every day	◯

On EACH *drinking occasion*, how many of the following would you normally drink?

Pints of beer/cider ______ Measures of spirits ______

Glasses of wine ______ Bottles of alcopops ______

Thank you very much for answering this and for helping us over the past year.

Your time is always so appreciated.


Baby Food Diary
The Baby Study

Using your Baby Food Diary

How do I record my baby's food intake?

This diary has sections to help you to describe your baby's foods and drinks. Write as many details as you can about the food or drink. In your description, please include:

Your **cooking method**:	fried, boiled, grilled, steamed, roasted, etc.
The **food texture**:	runny, thin, thick, smooth, soft, crunchy, crispy, lumpy, mashed, etc.

How should homemade foods be recorded?

You will have been given a set of spoons to help record your baby's food intake.

For each meal, write down the **number of spoons** and the **type of spoon** used for **each food** your baby eats, **e.g. 12 teaspoons of porridge**.

How should food in packets and jars be recorded?

Food pouches

1. Write down the name and brand of the pouch.
2. Record how much of the food was eaten, e.g. whole pouch, half pouch, 5 teaspoons, etc.

Jars & Cans

1. Write down the name and brand of the jar or can.
2. Write down the age marked on the label, e.g. 4+ months.
3. Record how much of the food was eaten, e.g. full jar, 5 teaspoons, half of the can, etc.

Boxes & Packets

1. Write down the name and brand of the box or packet.
2. Record how many spoons of the **dry** food that you pour out, e.g. 6 teaspoons of powdered cereal without water or milk.
3. Record how much of the food was eaten, e.g. full bowl, 5 teaspoons, etc.

Date:

Type of meal	**Meal** ◯ **Snack** ◯ **Drink** ◯	**Meal** ◯ **Snack** ◯ **Drink** ◯	**Meal** ◯ **Snack** ◯ **Drink** ◯	**Meal** ◯ **Snack** ◯ **Drink** ◯
Name the food or drink				
How was the food cooked? (E.g. fried, baked, boiled, steamed)				
How much was eaten? (E.g. 6 teaspoons, half a jar)				
Was anything added to the food? (E.g. sauce, sugar, butter, salt, gravy)				
Texture of food (E.g. mashed, crunchy, hard, crispy)				
Who's feeding baby? (E.g. mammy, daddy, granny, child-minder)				

Date:

Type of meal	**Meal** ◯ **Snack** ◯ **Drink** ◯	**Meal** ◯ **Snack** ◯ **Drink** ◯	**Meal** ◯ **Snack** ◯ **Drink** ◯	**Meal** ◯ **Snack** ◯ **Drink** ◯
Name the food or drink				
How was the food cooked? (E.g. fried, baked, boiled, steamed)				
How much was eaten? (E.g. 6 teaspoons, half a jar)				
Was anything added to the food? (E.g. sauce, sugar, butter, salt, gravy)				
Texture of food (E.g. mashed, crunchy, hard, crispy)				
Who's feeding baby? (E.g. mammy, daddy, granny, child-minder)				

Date:

Type of meal	**Meal** ◯ **Snack** ◯ **Drink** ◯	**Meal** ◯ **Snack** ◯ **Drink** ◯	**Meal** ◯ **Snack** ◯ **Drink** ◯	**Meal** ◯ **Snack** ◯ **Drink** ◯
Name the food or drink				
How was the food cooked? (E.g. fried, baked, boiled, steamed)				
How much was eaten? (E.g. 6 teaspoons, half a jar)				
Was anything added to the food? (E.g. sauce, sugar, butter, salt, gravy)				
Texture of food (E.g. mashed, crunchy, hard, crispy)				
Who's feeding baby? (E.g. mammy, daddy, granny, child-minder)				

Date:

Type of meal	**Meal** ◯ **Snack** ◯ **Drink** ◯	**Meal** ◯ **Snack** ◯ **Drink** ◯	**Meal** ◯ **Snack** ◯ **Drink** ◯	**Meal** ◯ **Snack** ◯ **Drink** ◯
Name the food or drink				
How was the food cooked? (E.g. fried, baked, boiled, steamed)				
How much was eaten? (E.g. 6 teaspoons, half a jar)				
Was anything added to the food? (E.g. sauce, sugar, butter, salt, gravy)				
Texture of food (E.g. mashed, crunchy, hard, crispy)				
Who's feeding baby? (E.g. mammy, daddy, granny, child-minder)				

"Be yourself – everyone else is already taken"

– Oscar Wilde

"You have brains in your head,
You have feet in your shoes,
You can steer yourself in any direction
you choose"

– Dr Seuss

"If you have good thoughts, they will shine out of your face like sunbeams and you will always look lovely"

– Roald Dahl

Front of the feedback card on the measurements of 12-month-old infants

Name: ______________________________

Measured on: _____ ______________ _______

Age at measurement: _____ months old

Physical measurements

Head circumference	__________ cm
Mid-arm circumference	__________ cm
Chest	__________ cm
Tummy	__________ cm
Mid-thigh circumference	__________ cm
Foot	__________ cm
Length	__________ cm
Total weight	__________ kg or _____ lbs _____ oz

Summary of growth over the first year

Back of the feedback card on the measurements of 12-month-old infants

Dad's point-of-view

The Baby Study

Ospidéal Mhuire na Leanaí, Cromghlinn
Our Lady's Children's Hospital, Crumlin

Coombe Women & Infants University Hospital

DIT

Why am I being asked to fill in this survey?

To improve services provided to parents, we need to understand more about raising a baby in Ireland. We've gotten information from mothers in this study, and now it's the turn of fathers to tell us their side of the story.

Please complete this survey to help us to build a picture of what fathers experience during their partner's pregnancy and during the early months of their infant's life.

What sort of questions will I be asked in this survey?

To build a picture of becoming a Dad in Ireland, questions will be asked on:

- Your role in your partner's pregnancy
- Feeding your new baby
- The changes a new baby brings

Is the information I provide anonymous?

Yes. **The information provided here is anonymous.** Your details are not held after posting, so no fathers can be identified.

Where can I get the results of the survey?

We hope to publish the survey results by the end of 2015. If you want to receive the results, please text your name and address to 086 069 9221. Your survey will remain anonymous and the overall survey results will be posted to you once they become available.

What if I have questions?

If you have any questions, or have lost your envelope to return this survey, please contact Annemarie.

Address: School of Biological Sciences
Dublin Institute of Technology
Kevin Street
Dublin 8

Phone: 086 069 9221

Email: annemarie.bennett@dit.ie

Section 1 of 3: My experience of my partner's pregnancy

1. **If you could pick one topic that you think fathers should have information on about pregnancy, what would it be?** ________________________________

   ____

2. **Thinking of your partner's most recent (or only) pregnancy, how included did you feel in your partner's healthcare throughout the whole pregnancy?**

   I felt completely included with my partner's healthcare ◯

   I felt included most of the time with my partner's healthcare ◯

   I felt neither included nor excluded with my partner's healthcare ◯

   I felt excluded most of the time with my partner's healthcare ◯

   I felt completely excluded with my partner's healthcare ◯

3. **Who or what were your TWO most useful sources of information on what to expect during your partner's pregnancy?**

Past experience	◯	Internet	◯
My partner	◯	Other fathers	◯
Doctor	◯	Family	◯
Midwife	◯	Friends	◯
Books	◯	Other _Name source_	◯

4. **Are you aware that all fathers have a once-off entitlement to take time off work to attend two classes of an antenatal course?**

Yes ◯ **No** ◯

5. **Did you attend any antenatal classes during your partner's most recent (or only) pregnancy?**

Yes ◯

How many antenatal classes did you attend? ______

Did you find the classes useful?

Yes ◯ No ◯

No ◯

Was there any particular reason that you did not attend antenatal classes?

Didn't feel that I needed to attend ◯

Attended classes when my partner was pregnant before ◯

Work commitments ◯

Other ____Please give reason____ ◯

6. **Overall, did you feel that you had enough information on what to expect during your partner's pregnancy?**

Yes ◯

No ◯

What information would you have liked to have had?

____

____

7. **For YOU, what was the most stressful part of your partner being pregnant?**

____

____

Section 2 of 3: My experience of milk feeding

1. Did your partner ever breastfeed?

Yes ◯ — **Go to question 2**

No ◯ — **Go to question 11**

2. Were you involved in her decision to breastfeed? Yes ◯ **No** ◯ — **Go to question 4**

3. How did you influence her decision?

I encouraged her to breastfeed ◯

I had some concerns, but I didn't discourage her from breastfeeding ◯

I would have preferred it if my partner did not breastfeed ◯

I didn't mind how the baby was fed – I let my partner decide ◯

Other ____ ◯

4. What was your most useful source of information on breastfeeding?

I did not want any information on breastfeeding ◯

I didn't think I needed any information on breastfeeding ◯

Past experience of my partner breastfeeding ◯

My partner's instructions ◯

Lactation consultant's advice ◯

Book ◯

Internet ◯

Family ◯

Friends ◯

Other ________Name this source________ ◯

5. **What (if anything) surprised you about the process of breastfeeding?**

____

____

6. **As a dad, what are the main advantages (if any) of having a breastfeeding partner?**

____

____

7. **As a dad, what are the main disadvantages (if any) of having a breastfeeding partner?**

____

____

8. **Feeding is an important way to bond with a baby. When your partner breastfeeds, how do you prefer to bond with the baby?** *(tick all that apply)*

Bathing the baby ◯

Changing the baby ◯

Putting baby to sleep ◯

Comforting baby ◯

Playing with baby ◯

Other ◯ ________Name method(s)________

9. **Having some difficulty breastfeeding is common amongst women in Ireland. Did you have enough information to help your partner with any difficulties that she had with breastfeeding?**

My partner had no difficulty breastfeeding ◯

I had enough information to help my partner with breastfeeding difficulties ◯

I did not have enough information to help my partner with breastfeeding difficulties ◯

10. What information (if any) would have made breastfeeding easier for your partner?

____

____

11. Have you formula-fed your baby at any time? **Yes** ◯ **No** ◯

Go to question 17

12. Were you involved in the decision to formula-feed your baby? Yes ◯ **No** ◯

Go to question 14

13. How did you influence her decision?

I encouraged her to formula-feed ◯

I encouraged her to breastfeed ◯

I didn't mind how the baby was fed – I let my partner decide ◯

Other ____ ◯

14. As a dad, what are the main advantages (if any) of formula feeding a baby?

____

____

15. As a dad, what are the main disadvantages (if any) of formula feeding a baby?

____

____

16. **Who or what was your most useful source of information on formula feeding?**

I did not want any information on formula feeding	◯
I didn't think I needed any information on formula feeding	◯
Past experience of formula feeding	◯
My partner's advice	◯
Information from an infant formula company	◯
Internet	◯
Family	◯
Other ________Name this source________	◯

17. **If you saw a woman breastfeeding in public (like the picture below), what would your first reaction be?**

Discomfort, not sure 'where to look'	◯
Respect	◯
Gladness	◯
Surprise	◯
Embarrassment	◯
Wouldn't think anything of it	◯
Disgust	◯
Other __________please state__________	◯

18. How comfortable would you be if your partner ever breastfed in public?

Completely comfortable ◯

Fairly comfortable, but I would have a few concerns ◯

What would your main concerns be?

___

Completely uncomfortable, I'd have a lot of concerns ◯

What would your main concerns be?

___

Section 3 of 3: The changes a new baby brings

1. During the pregnancy, think of how you imagined the early months of having a new baby. Is there anything about the reality that you weren't expecting?

Yes ◯ **No** ◯

What was unexpected about the early months of having the baby?

___

2. Was there a particular time since your baby came home that you would have liked more support?

Yes ◯ **No** ◯

When would you have liked more support?

___

What kind of support would you have liked?

___

A few things about you…

1. **What age were you when your last (or only) baby was born?** _____ years old

2. **Are you a first-time father?**

   Yes ◯ **No** ◯

   How many other children do you have? _____

3. **Are you a married father?**

   Yes ◯ **No** ◯

   Do you have joint **guardianship rights** with the mother of your baby?

   Yes ◯ No ◯

   Guardianship rights give you the legal right to make major decisions in your child's life, e.g. where they live, decisions on medical treatment, and where they attend school.

   When a baby is born, an unmarried mother has full guardianship over the baby. Having your name on the birth certificate **does not** give you guardianship rights. Unmarried fathers must apply to become a guardian of their baby. See www.citizensinformation.ie or www.treoir.ie for more information.

4. **What is your nationality?** ________________________________

5. **What is your employment status at the moment?**

   Stay-at-home Dad ◯

   Working full-time ◯

   Working part-time ◯

   Currently unemployed ◯

6. **What is the highest level of education you have completed to date?**

   No formal education ◯

   Primary school education ◯

   Secondary education ◯

   Vocational qualification ◯

   Level 7 degree ◯

   Level 8 degree (bachelor degree) ◯

   Postgraduate certificate or diploma ◯

   Masters ◯

   Doctorate ◯

7. **What is your current living situation with your partner?**

Married and living with my partner ◯

Not married but living with my partner ◯

Not married and not living with my partner ◯

Thank you so much **for answering these questions. Please write below if you have:**

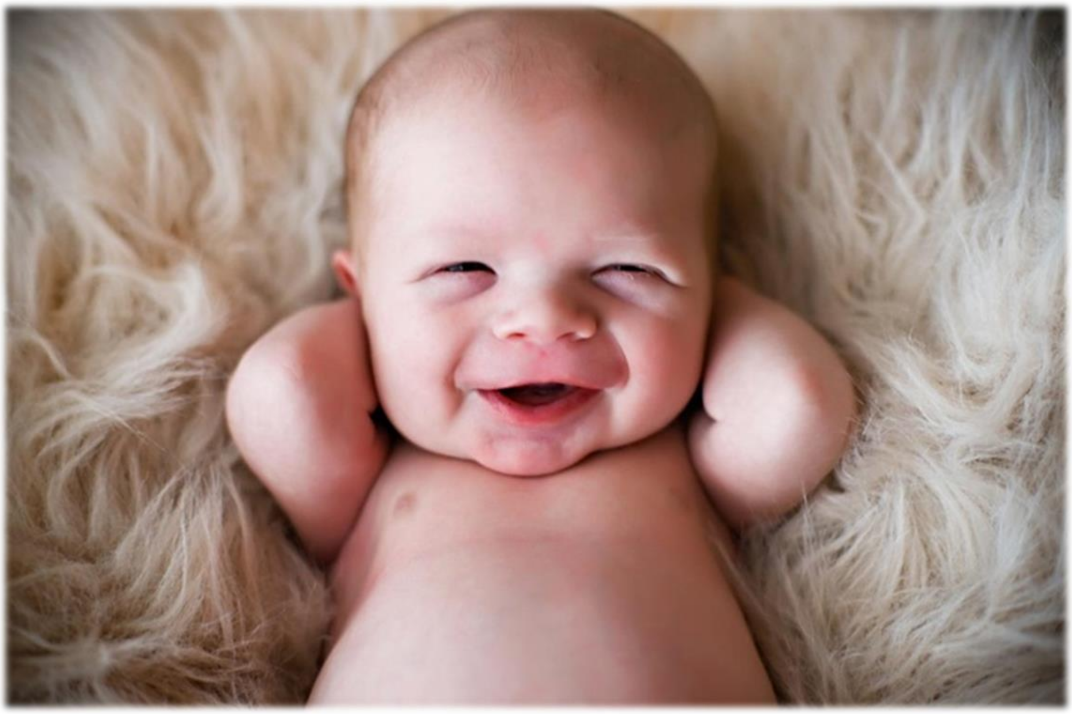
- Any advice on becoming a Dad in Ireland that you think more Dads should be aware of; or
- Any other comments on your experience of becoming a Dad.

____

____

____

____



Cheers!

[Date]

Dear [first name],

Why have we sent you this survey?

About **65,000 babies** are born in Ireland every year.

However, only **one study* on 67 Irish Dads** has been carried out in an attempt to understand what men think about becoming a Dad in Ireland. This study involved men whose partner had given birth two days previously.

<u>As such, we know almost nothing about what fathers in Ireland need to raise a baby.</u> However, we would like to know, and so, to help improve our support services for parents, we are asking fathers to share their views on becoming a Dad in Ireland.

How long does the survey take?

It takes about 10 minutes to complete the survey (sometimes longer if you have a baby on your knee!). This is the only survey you will receive from us.

Why was this survey sent to me?

The handling of your name and address is explained over the page.

We will accept completed surveys until the end of [month and year]. If you have any questions, contact Annemarie on 086 069 9221. Thank you very much for your time – we really appreciate it!

With kindest regards,

____

Annemarie Bennett

Why was this survey sent to me?

When your partner was pregnant, she named you as her next-of-kin. We sent this survey to partners who were listed as next-of-kin and who had term babies.

Only individuals working in the Coombe Hospital have handled your name, address, and the posting of your survey. Your details are not held after posting, and so, **the survey you return to us is anonymous.**

If you would like to receive the results of the survey, please text your name and address to 086 069 9221. Your survey will remain anonymous and the overall survey results will be posted to you once they become available.

The Coombe Hospital is a research and teaching hospital. It partners with several universities to produce good research and improve patient care. The Coombe Hospital partners with Dublin Institute of Technology on some research projects. Dublin Institute of Technology is funding this study, and helping to analyse the results, and this is why the completed surveys are stored in DIT.

* Study by Kenosi and colleagues (2011), available at: http://imj.ie//ViewArticleDetails.aspx?ArticleID=6853

DANONE
BABY NUTRITION

Block 1, Deansgrange Business Park, Deansgrange, Co. Dublin.
Tel: +353 1 289 0289 Fax: +353 1 289 0250

Dr. John Kearney
School of Biological Sciences
Dublin Institute of Technology,
Kevin Street,
Dublin 8

31st January 2013

Re: DIT Infant Feeding Research Study

Dear Dr. Kearney,

On behalf of Danone Baby Nutrition, we would like to confirm that whilst we have agreed to part-fund this important research, we have no involvement in the study design, nor in the development of instruments, execution, data analysis or write up of this study. Furthermore, we acknowledge that we have no affiliations with the Coombe Women's Hospital.

I trust that this information is satisfactory. Should you require additional information or assistance, please do not hesitate to contact me.

Yours sincerely,

Aileen Regan

Aileen Regan

Medical Director

Letter clarifying the role of the commercial study funder

PUBLICATIONS AND CONFERENCE ABSTRACTS

Bennett, A.E., McCartney, D., Kearney, J.M., 2016. Views of fathers in Ireland on the experience and challenges of having a breast-feeding partner. *Midwifery* 40, 169-176.

Bennett, A.E., McCartney, D., Kearney, J.M., 2016. Views of fathers in Ireland on breastfeeding in public. Presented in March 2016 at the *Nutrition and Growth* Conference in Vienna, Austria.

Bennett, A.E., Kearney, J.M., 2016. Insights from fathers in Ireland on their ability to support their breastfeeding partner. Presented in December 2016 at the *Diet, Nutrition and Mental Health and Wellbeing* Conference in London, United Kingdom.

Bennett, A.E., Kearney, J.M., 2016. Factors associated with distress amongst a sample of Irish mothers at 4 months post-partum. Presented in December 2016 at the *Diet, Nutrition and Mental Health and Wellbeing* Conference in London, United Kingdom.