An exploration into the use of galactagogues among breastfeeding women in Aotearoa and the factors associated with use

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Abstract

Background: Galactagogues are herbal, food, or pharmaceutical substances increasingly used to enhance breast milk production in breastfeeding women. Despite limited evidence on galactagogue efficacy and use generally, literature has reported use of G associated use with perceived insufficient milk; a mother's belief that their quality or quantity is insufficient to meet infant needs. This thesis aims to describe the type, duration, and purpose of galactagogue use by breastfeeding women in Aotearoa. Additionally, this study will identify factors associated with galactagogue use and explore associations with perceived insufficient milk supply.

Methods: A quantitative cross-sectional online survey was distributed via study advertisements on Facebook, the Le Leche League, Lactation Consultants, or by word of mouth. Women currently breastfeeding, or who breastfed in the past year, aged 16+ in Aotearoa, were eligible. The 58 question survey included demographics, birth characteristics, breastfeeding practices and galactagogue behaviours. The data were analysed using descriptive statistics and bivariate and logistic analyses.

Results: In total, 763 women were included in this study. More than half the participants (63.8%) reported using a galactagogue. The most commonly reported galactagogues were oats (71.1%), followed by lactation cookies (59.3%) and nuts and seeds (42.1%). Bivariate analyses found galactagogue use was higher among primiparous women (68.8% vs 57.6%, p=0.001), those with caesarean births (70.4% vs 60.4%, p=0.010), having previously used galactagogues (yes=69% vs no=30.3%, p=<0.001), those concerned with perceived insufficient milk quantity (44% vs 78%, p=<0.001), and perceived insufficient milk quality (54% vs 75.4%, p=<0.001). Multivariate analysis found perceived insufficient milk quantity was the only predictor of galactagogue use. Many women who never reported perceived insufficient milk quantity (54%) or quality (44%) still reported galactagogue use. The most common reason for using galactagogues was to increase milk supply (47.9%). Nearly two-thirds of women (60.5%) commenced galactagogue use within the first four weeks postpartum. Using a galactagogue for less than one week was uncommon (<13%).

Conclusion: This study revealed that galactagogue use was high among breastfeeding women in Aotearoa. Mothers concerned about perceived insufficient milk quantity or quality were more likely to use galactagogues, yet a significant proportion of mothers who never questioned these aspects were also users. Qualitative research is needed to clarify decision making processes and influences.

Keywords: breastfeeding; lactation; galactagogues; perceived insufficient milk supply; PIM; women; Aotearoa

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List of Abbreviations

Abbreviation	Term
AIM	Actual Insufficient Milk
BC	Before Christ
BF	Breastfeeding
EBF	Exclusive Breastfeeding
HCP	Health Care Professional
MOH	Ministry of Health
MUHEC	Massey University Human Ethics Committee

NBF	Non-breastfeeding
NCEA	National Certificate for Educational Achievement
NEBF	Non-Exclusively Breastfeeding
NHANES	National Health And Nutrition Examination Survey
NZ	New Zealand
NZQF	New Zealand Qualifications and credentials Framework
OTC	Over-the-counter
PIM	Perceived Insufficient Milk
PBF	Partial Breastfeeding
RCT	Randomised Control Trial
SD	Standard Deviation
SIDS	Sudden Infant Death Syndrome
SPSS	Statistical Package for the Social Sciences
TCIM	Traditional, Complementary and Integrative Medicine
UK	United Kingdom
UNICEF	United Nations International Children's Emergency Fund
US	United States
WHO	World Health Organization

Chapter One: Introduction

Breastfeeding (BF) is considered the "gold standard" of infant nutrition, providing optimal macro and micronutrients for brain development, promoting growth, optimising gut biodiversity, preventing infection, and providing protective factors for short and long-term health outcomes (Eglash et al., 2008; Lawrence & Lawrence, 2016). The World Health Organization (WHO) and Ministry of Health New Zealand (MOH) recommend Exclusive Breastfeeding (EBF) for up to six months of life, beginning complementary feeding at this stage, and maintaining BF for up to two years of life or beyond (Lessen & Kavanagh, 2015; Ministry of Health, 2021). These recommendations are based on research outlining BFs short- and long-term physical and mental health benefits for the infant and mother (Eglash et al., 2008; Ip et al., 2007; Victora et al., 2016; Yuen et al., 2022).

EBF is defined as an infant receiving only breast milk from their mother, no other liquids or solids -not even water- with the exception of oral rehydration solution or drops/ syrups of vitamins, minerals, or medicines as their source of nutrition (Elyas et al., 2017). Rates of EBF to six months of age are well below 100% despite the well-established benefits. Global data showed that only 48% of infants < six months are EBF, and 68% of 12-23 month-olds continue to be breastfed (UNICEF: For Every Child, 2022). Locally, the New Zealand Health 2021 survey data showed that among children aged six months to <6 years, 9.5% of infants were EBF till six months (Ministry of Health, 2022). Evidence stands that any BF has positive outcomes for both mother and infant (Chowdhury et al., 2015; Horta & de Lima, 2019; Qiao et al., 2020; Tschiderer et al., 2022).

Although EBF is the 'gold standard', attaining this practice is a complex and multifaceted issue; women may experience many difficulties, which are well-documented in the literature (Gianni et al., 2019; Patil et al., 2020). Difficulties can range from nipple and breast pain to infant anatomy challenges or taboos around BF, and all aspects of mothers' lives may influence their ability to BF and subsequently

lead to premature cessation (Acharya & Khanal, 2015; Gianni et al., 2019; Mahurin-Smith, 2023; Morrison et al., 2019; Patil et al., 2020). Perceived insufficient milk supply (PIM) is one of the most commonly attributed individual factors influencing early BF cessation (Brown et al., 2014; Colin & Scott, 2002; Gianni et al., 2019; Huang et al., 2022; Kirkland & Fein, 2003; Morrison et al., 2019).

PIM is defined as "the mother's belief that the quality or quantity of her breast milk is insufficient to meet the infant's hunger or nutritional need" as per Huang et al. (2022). This is based on maternal perception and does not indicate insufficient milk supply; in actuality, supply may be adequate. Actual insufficient milk supply (AIM) is when the mother physically cannot produce enough milk to meet her infant's needs and can be a result of primary or secondary causes (Lee & Kelleher, 2016). It is important to note that in many cases, mothers who experience PIM and make behavioural changes, i.e., supplement feeding with formula, which may lead to a lowered or insufficient milk supply (Huang et al., 2022). PIM is cited as being commonly experienced by BF women and is one of the most frequent reasons for the early cessation of the practice. A meta-analysis conducted by Huang et al. (2022) on the rates and factors associated with PIM indicated that 25% of mothers who EBF or partially breastfed (PBF) experience PIM at one week post-partum. Further, between one and four months 15-50% experienced PIM, and at four to six months 10-60% of EBF or PBF mothers experienced PIM. Furthermore, up to 50% of the time, PIM was the reported reason for stopping BF altogether before the recommended period.

Given the high prevalence of PIM, among other difficulties, the need for management strategies is key in ensuring that women meet the BF recommendations. Evidence suggests that for the most effective BF outcomes, healthcare professionals (HCPs) should provide adequate education (Huang et al., 2022), feel confident, collaborate with family and community, develop practical communication skills, and work to close the gap in health inequality (Demirtas, 2012). The first line of treatment for issues related to milk supply, is to increase the frequency of BF sessions per day (Lawrence & Lawrence, 2016). However, BF management requires a multifactorial approach. Despite increasing BF frequency

being the gold standard recommendation, these are not the only strategies cited as being used to help increase milk supply within this population. Research indicates that one of these strategies includes using galactagogues, and HCPs suggest taking galactagogues alongside well-established BF management methods, not in isolation (Brodribb, 2018; Forinash et al., 2012; Kent et al., 2012). However, how galactagogues are used practically by BF women may differ from what is suggested.

Galactagogues are pharmaceutical agents, herbs, or food sources used in the diet to induce, maintain, or support BF (Foong et al., 2020; Penagos Tabares et al., 2014). Pharmaceutical galactagogues are pharmacological substances that are used to induce and maintain lactation, these include medicines such as metoclopramide and domperidone (Penagos Tabares et al., 2014). A large majority of galactagogues are herbal or food products believed to aid in increasing milk production (Penagos Tabares et al., 2014). There is a wide range of reported herbal galactagogues used by BF women, some of which include items such as milk thistle, fenugreek, fennel, oats, millet and lactation cookies (Brodribb, 2018; Mortel & Mehta, 2013; Ryan et al., 2023).

The evidence of the efficacy and effectiveness of pharmacological and herbal galactagogues is limited and inconsistent. The studies looking at these substances have limitations that decrease the validity of the results, and there is not enough Grade A evidence to recommend their use (Mortel & Mehta, 2013). Despite this, the use of these substances is widespread. Although the research detailing the prevalence of galactagogue use in BF women is limited, evidence from several studies estimates galactagogue use ranges from 54–91.7% (Abdul Ghani et al., 2020; McBride et al., 2021; Molavi Vardanjani et al., 2022; Ryan et al., 2023; Steyn et al., 2017). Significant differences between Western and non-Western populations were identified and may stem from differences in the cultural practices surrounding BF (Ali et al., 2020; Buntuchai et al., 2017; Chao et al., 2020; Jendras et al., 2020). Only one small study conducted in Aotearoa has investigated use in this population. Jia (2023) conducted

a cross-sectional observational study with a non-random sample of 72 women from Aotearoa and found that 58% of participants were galactagogue users.

Mothers generally understand the importance of BF and are motivated to follow the recommendations (Beggs et al., 2021; Pinto et al., 2016). When difficulties arise, strategies to mitigate these are sought and is often when galactagogues are introduced. Use is more frequently associated with first-time mothers, those who had a caesarean section, those whose infants required supplemental feeding with infant formula or those who had preterm births (Grzeskowiak et al., 2015; Karapati et al., 2021; McBride et al., 2021; Molavi Vardanjani et al., 2022; Ryan et al., 2023). Of importance to this thesis is the research that indicates galactagogues are commonly used by women when they perceive they have insufficient milk supply and wish to increase this (Molavi Vardanjani et al., 2022; Shen et al., 2023; Sim et al., 2014; Steyn et al., 2017).

1.1 Summary and Justification of Research

In the literature, it is suggested that galactagogues are used extensively among BF women globally, despite the current limited evidence for their efficacy or effectiveness. Types of galactagogues and reasons for their use vary depending on the context; however, their use as a result of PIM is commonly cited. In Aotearoa, investigations into their use are limited, with only one small study conducted. Understanding use in this population is essential, given the potential barriers, harm or lack of benefits that come with use. This harm derives from the potential displacement of other effective BF strategies that may be dismissed as galactagogues become relied on, and the lack of efficacy evidence and guidelines that currently stands for the use of these substances. Understanding the prevalence and reasons behind their use in Aotearoa can help make HCPs more informed of the use and ensure women are adequately educated when it comes to the most effective ways to continue BF, with or without galactagogue use.

1.2 Statement of the Problem

Many mothers globally and in Aotearoa do not meet the BF recommendations set by the WHO, and there are many factors related to its cessation. Given the significant health benefits of BF for mothers and infants, many women look to alternate strategies to address the factors that may lead to cessation. Galactagogues are a commonly cited strategy used to help induce, maintain, and promote milk production; however, there is currently limited research that focuses on galactagogues use and, to date, no comprehensive studies that look at their use in Aotearoa.

1.3 Study Purpose

Understanding the scope of galactagogue use by BF women in Aotearoa and the reason behind their use. Firstly, as there is currently little comprehensive research to indicate these practices in Aotearoa, and secondly, it can be used as a springboard to guide and drive further research in this area.

1.4 Aims

The current study aims to understand the use of galactagogues by BF women in Aotearoa.

1.5 Objectives

This study will collect data from BF women to describe the type, and duration of galactagogue use by BF women in Aotearoa, understand when and why women are using galactagogues during BF, understand the factors associated with galactagogue use, and investigate how galactagogue use is related to perceived breast milk insufficiency.

1.6 Hypothesis

It is hypothesised that the use of galactagogues, including foods, herbal substances, and pharmacological galactagogues, is prevalent in BF women in Aotearoa. We hypothesise that galactagogue use will be more common among older mothers, primiparous women, and women who experienced caesarean section births. We hypothesise that the use of galactagogues will be related to women's perceived breast milk insufficiency.

1.7 Thesis Structure

The thesis will be divided into the following sections:

Chapter 1, Introduction: Gives background information to set the scene for the thesis, provides an overview of the research area and concludes by outlining the aims, objectives, hypothesis, and scope of the research project.

Chapter 2, Literature Review: Provides an extended literature review of the current relevant literature for this topic. This chapter also provides definitions of BF, galactagogues, and perceived insufficient milk.

Chapter 3, Research manuscript: This provides a complete and concise presentation of the study. This includes; the abstract, methods, results, discussion, strengths and weaknesses, conclusion, and references. Formatting guidance for this manuscript was obtained from the Journal of Nutrition.

Chapter 4, Conclusion: This describes the research outcome and impacts, the strengths and weaknesses of this study, and provides final recommendations based on the outcomes of the research.

1.8 Researchers Contribution

Researcher	Contribution
Madeline Gash- MSc Nutrition and Dietetics Student	Thesis primary author, participant recruitment, assist with survey development, data collection, data analysis, and thesis write-up.
Dr. Janet Weber (Primary Supervisor)	Supervision of MSc student, MUHEC ethics application, survey development, assistance with data collection, assistance with statistical analysis, thesis review and support.
Associate professor. Louise Brough (Secondary Supervisor)	Supervision of MSc student, MUHEC ethics application, survey development review, assistance with statistical analysis, thesis review and support.
Dr. Lily Jia (Secondary Supervisor)	MUHEC ethics and survey development review.

Chapter Two: Literature Review

This chapter provides background on breastfeeding (BF) and galactagogues. This is followed by a review of the literature on the use of galactagogues by breastfeeding (BF) women globally, the factors that lead to use, and the nature of their use in this population, including specific types, reasons for, commencement and duration of use.

2.1 Breastfeeding

For this thesis, BF is defined as feeding an infant milk that comes from the human breast, directly or as expressed milk. BF is considered the gold standard nutrition source for infants, as its uniqueness promotes optimal growth and development (Eglash et al., 2008). Exclusive Breastfeeding (EBF) is defined as when an infant receives only breast milk from their mother, no other liquids or solids -not even water- with the exception of oral rehydration solution, or drops/ syrups of vitamins, minerals, or medicines, as their source of nutrition for the first six months of life (Elyas et al., 2017).

2.1.1 Milk Production

Lactation comprises two stages: secretory initiation and secretory activation (Alekseev, 2021). Colostrum production begins during pregnancy, continues to the initial days postpartum, and is associated with secretory initiation. Secretory activation occurs with a decrease in progesterone and oestrogen post-birth. Prolactin becomes the dominant hormone, progressively enhancing milk production and overall volume (Ballard & Morrow, 2013). In these early days, prolactin is a key hormone in BF, and milk production may be increased with nipple stimulation as this aids in increasing prolactin levels. Changes in milk production and composition occur on a continuum, with rapid changes within the first four days post-birth and then slower progressive changes throughout lactation (Neville et al., 2001).

By approximately day ten, postpartum milk composition and production becomes established and is often associated with the term 'mature milk' (Lawrence & Lawrence, 2016) Adequate breast milk production is necessary for infants to meet their nutritional needs. Long-term postpartum milk production is maintained and regulated by removing milk, and the actual milk volume secreted is closely linked to adequately draining the breast (Lawrence & Lawrence, 2016). In combination, this leads to greater prolactin production and milk production, emphasising the importance of regular feeding and milk removal (World Health Organization, 2009).

2.1.2 Breastfeeding Recommendations

As the World Health Organization (WHO) outlines, current BF recommendations state BF should be initiated within the first hour after birth and infants should be EBF for the first six months of life (World Health Organization, 2015). Following this period, infants should receive safe and adequate complementary foods alongside continued BF until at least 24 months. The WHO advises BF is performed on demand, and parents/ caregivers should refrain from using pacifiers, teats, or bottles.

In alignment with WHO, the Ministry of Health New Zealand (MOH) recommends infants should be EBF for the first six months of life, either directly from the breast or through expressed breast milk. Breast milk alone is no longer sufficient to meet nutritional needs for optimal growth and development at six months. Hence, at approximately six months, complementary foods must be introduced while continuing to BF to at least 24 months of age or beyond (Ministry of Health, 2021).

2.1.3 Benefits of BF for the Infant

BF recommendations are based on robust evidence concerning both maternal and infant health. While EBF is optimal for the first six months of infants' lives, any breast milk intake proves beneficial for infants, as demonstrated by recent meta-analyses (Horta & de Lima, 2019; Horta et al., 2015a, 2015b; Qiao et al., 2020; Xue et al., 2021).

Horta and de Lima (2019) carried out a recent meta-analysis comprising 14 studies that established a protective association between any BF and type 2 diabetes diagnosis, and this effect was higher among adolescents. Qiao et al. (2020) conducted a meta-analysis on the association between BF and early childhood obesity, comprising 26 studies, this concluded that there is a significantly lower risk of obesity in children who were ever BF compared to those who had never been. Infants BF for more than six months had a more significant effect. Notably, EBF further reduced the risk of childhood obesity compared to those who were mix-fed. Moreover, Horta et al. (2015) conducted a meta-analysis of 105 studies on long-term health outcomes and their association with BF. They concluded that BF subjects were less likely to be classified as overweight/ obese at any age compared with mixed or no BF. Xue et al. (2021) explored the association between BF and childhood asthma risk in a meta-analysis of 23 studies, concluding that longer duration and/or more EBF correlated with a lower risk of childhood asthma. Cognitive ability has also been investigated concerning BF and the Intelligence Quotient. Horta et al. (2015) found increased performance in intelligence tests among children and adolescents who were ever BF in their meta-analysis of 17 studies.

Numerous meta-analyses were conducted to understand the short-term benefits of BF on infants. Key outcomes elicited include significantly lower infant mortality in all income countries (Fewtrell, 2004; Horta & Victora, 2013; Leon-Cava et al., 2002), reduced severity and morbidity from diarrhoea, fewer hospital admissions, decreased incidence of respiratory infections (Horta & Victora, 2013; Victora et al., 2016), and significant protection against Sudden Infant Death Syndrome (SIDS) in EBF infants (Hauck et al., 2011).

2.1.4 Benefits of BF for the Mother

While BF recommendations are primarily implemented to focus on positive infant outcomes, there are significant positive mental and physical effects observed for mothers.

In a meta-analysis by Chowdhury et al. (2015), which included 163 studies, BF was associated with a range of short and long-term maternal health outcomes. Lactational amenorrhoea rates at six months

postpartum were 23% higher in women who either exclusively or predominantly breastfed their infant for six months. Ever BF was associated with a reduced risk of breast and ovarian carcinoma, with longer durations of BF yielding greater protective effects. Lastly, longer lifetime BF was associated with a decreased risk of type 2 diabetes.

In a more recent meta-analysis BF for more than 12 months was associated with a reduced risk of diabetes and hypertension (Rameez et al., 2019). Furthermore, including eight studies in a systematic review and meta-analysis, Tschiderer et al. (2022) examined the association between BF and maternal cardiovascular risk. This concluded that parous women who had ever BF had a reduced risk for developing cardiovascular disease, coronary heart disease, stroke, and fatal cardiovascular disease compared to those who had never BF. However, the evidence was graded as very low to moderate using the Newcastle-Ottawa Scale. Many studies have examined the benefits of BF for the mother. However, it is important to note these are solely observational, given the ethical implications of Randomised Control Trials (RCTs) in this context.

Furthermore, EBF is economically beneficial. At the individual and family level, BF has been attributed to saving families estimated thousands in formula costs in the first year of life, and at the national level, costs are saved in health services when EBF infants tend to be more well and need less care (Kuma, 2015). Positive community benefits then flow on when infants and mothers reap the health benefits of EBF and are less likely to need to take time off work and schooling, be more present and contribute to society, and reduce the environmental burden that is associated with formula feeding (Kuma, 2015).

2.1.5 Current Breastfeeding Rates

Despite the robust evidence supporting current BF recommendations, global BF rates, exclusive or mixed, are reported to fall far below the 100% target set by the WHO (World Health Organization, 2003). Accurate global data on BF rates is difficult to obtain. Still, recent data estimates that 48% of

infants less than six months are EBF, and only 68% of 12–23 month-old infants are breastfed alongside complementary foods (UNICEF: For Every Child, 2022).

In Aotearoa, recent 2022 data from Plunket indicated BF rates largely unchanged since 2020, where at discharge, only 79.93% of infants were EBF (New Zealand Breastfeeding Alliance, 2020). Further, the most recent 2021 health survey data showed that among children aged six months to six years, only 9.5% of infants had been EBF till six months (Ministry of Health, 2022).

2.1.6 Factors Leading to BF Cessation

A large variety of BF difficulties are documented across the literature. A well-established common BF difficulty includes nipple and breast pain, which are commonly cited as contributing to early BF cessation (Gianni et al., 2019; Mahurin-Smith, 2023; Morrison et al., 2019). These can derive from incorrect positioning of the infant latch or other physiological reasons, including flat or inverted nipples, infant anatomy, and infections (Kent et al., 2015).

A second prominent difficulty is low milk production or 'insufficient milk', which can be classified as 'actual' or 'perceived'. Perceived insufficient milk (PIM) is defined as "the mother's belief that the quality or quantity of her breast milk is insufficient to meet the infant's hunger or nutritional need" as per Huang et al. (2022). This is based on maternal perception rather than objective measures. Actual insufficient milk (AIM) is when the mother physically cannot produce enough milk to meet her infant's needs and can have primary or secondary causes (Lee & Kelleher, 2016). Research indicates that both forms of insufficient milk are commonly experienced and linked to early BF cessation. A 2022 systematic review, including 27 studies and overall 6,331 mothers, looked at the rates and factors of PIM and classified women into Exclusive or partial breastfeeding (EBF/PBF), non-exclusively breastfeeding (NEBF), and non-breastfeeding (NBF) (Huang et al., 2022). This study identified that at different periods after delivery, approximately 50% of the mothers had reported PIM as being the reason for stopping BF. This study also found that PIM was more commonly associated with NEBF mothers who had experienced delayed initiation of BF (4.22-fold) and a lack of EBF knowledge (7.1-

fold). In those EBF and EBF/PBF mothers, PIM had a negative correlation with BF self-efficacy and their planned duration of BF, both factors influencing the decisions to cease BF.

Most women can produce enough breast milk. Physiologically and anatomically, women are equipped to breastfeed their child. As explained, milk production is regulated by the hormones prolactin and oxytocin alongside infant demand, and the composition of breast milk has evolved to meet an infant's specific needs (Pillay & David, 2023). Therefore, most women should be able to breastfeed and supply their infants with adequate milk, given they have the support and conditions that tend towards success (Brown et al., 2014; Lawrence & Lawrence, 2016). In addition, when problems arise women should be able to remedy these issues with the effective establishment of BF management strategies such as increased infant feeding or guidance with latching, (Lawrence & Lawrence, 2016). However, experiencing PIM has been linked with supplementing infants with formula which can negatively impact milk supply as the hormone-controlled process starts down-regulating when feeding frequency decreases (Huang et al., 2022). Effective and frequent milk removal is crucial in establishing and maintaining sufficient milk production. Feeding frequency may decrease as a response to PIM due to indicators such as a fussy baby or latching difficulties. Although these issues are not indicators of milk supply, mothers may respond with supplementation (McCarter-Spaulding & Kearney, 2001). This behavioural response of adding formula to the infant's diet, and as a consequence, reduced effective and frequent milk removal, which in turn may lead to an actual low milk supply.

2.2 Galactagogues

Galactagogues are substances defined as food or pharmaceutical substances that are consumed to stimulate milk production (Foong et al., 2020). The recorded use of galactagogues dates back to as early as the 4th century BC when the herb milk thistle, containing silybin, silydianin, and silychristin, was used to improve milk production (Karapati et al., 2021; Křen & Walterova, 2005; Penagos Tabares et al., 2014). Consuming foods with galactagogue properties is a common practice in many Asian and

African populations due to the long-standing beliefs in their ability to support or increase milk production (Ali et al., 2020; Shen et al., 2023; Tarrant et al., 2004).

Anecdotal reports of galactagogue use for enhancing breast milk production prompted efficacy trials to understand the underlying biological mechanisms (Penagos Tabares et al., 2014). However, the efficacy of these substances for BF and milk supply remains not entirely understood, and the research is limited.

2.2.1 Galactagogue Mechanisms

Pharmaceutical galactagogues, such as domperidone and metoclopramide, are primarily used off-label in the context of BF. These medicines have other primary uses; for example, domperidone is used to increase the movements or contractions of the small bowel and is used in instances such as nausea and vomiting (NZ Formulary, 2024). However, given the mechanisms of action, these medicines have been repurposed as galactagogues and may be used in the context of low milk supply. Synthetic or pharmaceutical galactagogues, used in modern medicine, are most commonly classified as dopamine antagonists. They predominately work on the hormone prolactin, closely linked to milk production. Dopamine antagonists block the dopamine two receptors in the central nervous system, interfere with pathways that down-regulate prolactin levels, and therefore lead to the synthesis and release of prolactin. These changes are proposed to increase milk protein synthesis and mammary cell proliferation (Penagos Tabares et al., 2014). These effects are why we see pharmaceutical galactagogues often used in the context of BF.

The proposed mechanisms of action for herbal galactagogues in the body concerning milk production are poorly understood and difficult to characterise (Penagos Tabares et al., 2014). However, some research has proposed the hypothesis that these substances mediate phytoestrogen action and endogenous oestrogen pathways, promoting the proliferation of mammary cells. This overall aids in increasing the expression of the prolactin receptor, ultimately having a similar response to the pharmaceutical action (Penagos Tabares et al., 2014). However, there is a wide range of herbal

galactagogues, as explained in 2.2.7, that may act in different ways in the body, and thus, depending on the type, the effects on the stages of lactation may vary.

2.2.2 Pharmaceutical Galactagogue Efficacy

A Cochrane review investigating the efficacy of pharmaceutical galactagogues to increase milk production for mothers who were providing expressed milk to their preterm infants identified only two relevant studies of adequate quality (Donovan & Buchanan, 2012). The review revealed a significant effect of domperidone improving expressed breast milk volume from mothers compared to pre-medication milk volumes, with a mean difference of 99.49ml/day. However, 15 studies were excluded due to various factors, highlighting the difficulty in designing high-quality studies evaluating galactagogue effects. A meta-analysis conducted in 2021, incorporating 16 studies, reported similar outcomes, with domperidone showing a significant increase in milk production for mothers of preterm infants but not in term infant mothers (Shen et al., 2021). Overall, evidence from these reviews has concluded that insufficient high-quality evidence remains to guide HCPs on adequate patient advice, given the inconsistent evidence and methodology variations in pharmaceutical trials. It is important to note domperidone is not approved for use in BF women in the United States due to safety concerns. However, it is used off-label in other countries, including Aotearoa.

2.2.3 Herbal Galactagogue Efficacy

Bazzano et al. (2016) reviewed herbal galactagogues, which included eight trials of sufficient quality. The review focused on fenugreek, Shatavari, garlic, and malunggay, as these were the only galactagogues with more than one study looking at their effects. However, the review encountered challenges in comparison due to the studies using four different methodologies to measure milk supply. This resulted in difficulties in interpreting and concluding the data. Three of the eight studies investigated the effect of galactagogues on prolactin levels compared to placebo. Significant increases were found in two: a rise of 32.87% vs 9.56% in one, and levels differed by 2,389mIU/L vs 412.64mUI/L

in the second. Infant weight gain was measured in two studies, and both reported significant increases (weight increased by 16.13% in the treatment group vs 5.68% in one study; in the second, babies weighed significantly more at four months; 6.64kg vs. 5.30kg). Across all eight studies, findings were inconsistent, and galactagogue effects ranged from null to statistically significant increases. The review could not draw any conclusions due to the limited and conflicting data. Kwan and Abdul-Rahman. (2021) conducted a scoping review of 13 RCTs on herbal galactagogue use, covering fenugreek, goat rue, milk thistle, Carduus, stinging nettle, melissa, caraway, anise, fennel, lemongrass, banana flower, malunggay, and shatavari. Although four studies on fenugreek showed milk supply increases, attention was brought to the null changes in maternal prolactin levels, indicating alternative mechanisms behind their effects and the need for further research. Conflicting outcomes were found in studies on goat's rue and milk thistle. No effects were seen in mothers consuming a herbal tea blend of stinging nettle, melissa, caraway, anise, fennel, and lemongrass. Similar to fenugreek, studies using banana flowers and ginger demonstrated significant increases in milk production but no differences in prolactin levels. Both malunggay and shatavari had evidence from studies indicating a significant increase in milk production after consumption, yet, no prolactin level differences were found. The review concluded that there remains a significant gap in research to demonstrate the efficacy of galactagogue use, as the evidence is too limited. These reviews reflect the current literature indicating the wide range of herbal galactagogue types used worldwide. This variation makes it challenging to conduct high-quality studies to provide clear outcomes when using these galactagogues. Thus, recommendations for use are hard to form, and the evidence is highly conflicting.

2.2.4 Health Professional Recommendations of Galactagogues

Given the lack of strong efficacy evidence for galactagogue use, it is crucial to understand the perspectives and concerns of the health professional community. HCPs are the primary prescribers of pharmaceutical galactagogues and are a common source of information for BF women (Brodribb, 2018; McBride et al., 2022; Sim et al., 2014; Tan et al., 2022). A 2019 systematic literature review of

22 articles explored women's and HCPs' perspectives on using herbal galactagogues. The review revealed a gap between the expectations women hold of HCPs and their knowledge and confidence in providing advice on the substances. HCPs highlighted the need for more education on complementary medicine, specifically their safety and efficacy, as these were significant causes for concern contributing to the 'gap' (Zheng et al., 2019). A single cross-sectional study reported in the review found that 70% of HCPs often recommended herbal alternatives to BF women, yet only 60% of respondents indicated that their use helped women increase their breast milk production. These outcomes highlight that these products are being recommended despite HCPs' understanding of their lack of efficacy. HCPs, independent of whether they recommended use, were also asked whether they had concerns with recommending galactagogues. 24% of respondents raised concerns about their use and cited a lack of appropriate recommendations and confidence as factors making them hesitant to provide advice on this topic (Bazzano et al., 2016b). These findings highlight the need for research to better understand the safety and efficacy of the substances and provide adequate education on how they should be used within this population.

2.2.5 Safety and Adverse Side Effects

Safety concerns regarding galactagogues derive from the adverse side effects that are reported in the literature. Pharmaceutical galactagogues were reported to come with a range of risks. Domperidone was linked with potential common side effects such as dry mouth, headaches, stomach cramps, and, in some cases, cardiac arrhythmia (McBride et al., 2023; McBride et al., 2021; Sim et al., 2014; Steyn et al., 2017). Prevalence ranges from 48–73% of women reporting adverse effects of domperidone (Hale et al., 2018; McBride et al., 2023). Hale et al. (2018) also found 92% of metoclopramide users reported side effects. These findings are consistently reported. A United States survey conducted by Bazzano et al. (2017) found that 100% of users reported side effects and stated they would not be users again due to negative mood changes. A meta-analysis examining the use of metoclopramide highlighted additional maternal side effects, including headaches, diarrhoea, fatigue, dizziness, depression, constipation, and insomnia. Limitingly, infant effects were not analysed in these studies.

The study further noted the data on serious and rare adverse effects were limiting, sample sizes were generally small, and thus emphasised the need for more data to assess metoclopramides' overall safety given possible negative side effects for both mother and baby (Hussain et al., 2021).

Assessing the safety of herbal galactagogues is difficult. Difficulties arise as safety should be evaluated on the individual level and there are many variations used across populations and limited knowledge of their mechanisms of action. Anecdotally, herbal galactagogues were reported to elicit side effects, including diarrhoea, unusually sweet body odour, headaches, and gastrointestinal disturbances (Bazzano et al., 2017; Brodribb, 2018; Penagos Tabares et al., 2014; Sim et al., 2014). The literature does report that women elicit herbal galactagogues to be more 'natural' and, therefore, are perceived as more 'safe' compared to pharmaceutical forms (Bazzano et al., 2017; Molavi Vardanjani et al., 2022; Sim et al., 2013). Despite anecdotal reports not indicating any 'serious' adverse side effects to herbal galactagogue use, this does not mean there are not any or that longer-term effects on mother and infant are not possible (Altman & Bland, 1995).

2.2.6 Prevalence of Use

Despite the current lack of knowledge about the safety and efficacy of all galactagogues, their use is widespread globally. While there is no single estimate of galactagogue use globally or at the national level, various studies were conducted to gauge their prevalence of use among BF women. I searched PubMed, Google Scholar, Discover Masset University, and Scopus using search terms including breastfeeding OR breastfed OR BF OR lactation OR breast milk, AND galactagogue* AND women or woman or female AND human OR humans, AND prevalence OR "current use". I set an alert to indicate when new material meeting these criteria was published.

Studies in several countries were conducted in recent years to provide insight into the prevalence of galactagogue use. However, it is important to note that the sample population of these studies often does not reflect the countries' true demographics and is a limitation of a large majority of the current data. A large cross-sectional study completed in the United States in 2020/2021 surveyed 1,294 BF

women aged 18–45 years and found that 57.5% of participants reported using any galactagogues during BF (Ryan et al., 2023). Despite the large sample size, it is important to note this study does comment on the limitation regarding the ethnic diversity of the recruited sample. Thus, it may not represent the use among the general population.

In Australia, McBride et al. (2021) surveyed 1,876 current or previous BF women in a large-scale study. This found that 60% reported using one or more galactagogues during BF. This study used non-probabilistic and snowballing sampling techniques through social media distribution. However, other than having a higher proportion of women born in Australia, all other demographics of the sample were proportional to the National Perinatal statistics at the time.

There is currently minimal data on the use of galactagogues in Aotearoa. Still, one observational cross-sectional study was carried out, including 72 BF women living in the North Island of Aotearoa. This study found that 58% of participants were using galactagogues , and 50% of users reported using more than one galactagogue (Jia, 2023).

In Asia, one study conducted in Malaysia surveyed 322 mothers with infants < six months old attending public and private health clinics, finding that 76% reported using at least one galactagogue. However, the reasons behind this usage were not investigated (Tan et al., 2022). another Malaysian study, focused on women's knowledge and practices regarding galactagogues but not prevalence. The results found that 58% of women claimed to have good knowledge of these substances, indicating familiarity within this population (Abdul Ghani et al, 2020).

In Iran, a cross-sectional study involving 625 mothers aged >18 years attending neonatal clinics related to Shiraz University reported a prevalence of use as 91.7% of respondents (Molavi Vardanjani et al., 2022). This is the highest reporting identified within published literature. However, the age-standardised prevalence was 52.1%, similar to the results from Australia, the United States, and South Africa (McBride et al., 2021; Ryan et al., 2023; Steyn et al., 2017).

Steyn et al. (2017) conducted a cross-sectional study on BF behaviour and galactagogue use, surveying 104 women experiencing care in Cape Town's private healthcare sector. It was reported that 54% of

participants used galactagogues. However, the study population may be biased as there may be characteristic differences between mothers engaging in public versus privately funded health care. For example, 56% of women reported EBF, a relatively high rate compared to 2016 UNICEF data that estimated a point estimate value of 31.6% of infants were EBF till six months (UNICEF: For Every Child, 2022). This indicates that the data and this study's findings may not represent the true population. Globally, galactagogue use ranges from just over 50% to nearly 100% of the population, and these values are influenced by many factors.

2.2.7 Commonly Cited Galactagogues

The rates of types of galactagogues used in populations vary across the globe and are reflected in the literature. These differences may derive from the availability, acceptability of use, and cultural norms, (Kousar, 2022). However, specific galactagogues were more commonly reported in the literature reviewed.

Two pharmaceutical galactagogues that are cited in the literature as being used include metoclopramide and domperidone. Research from this literature review indicated that these forms were often less commonly known and used by women than herbal or food galactagogues. Of the two, domperidone was more widely prescribed and used by women (Bazzano et al., 2017; Jia, 2023; McBride et al., 2021; McBride et al., 2022). McBride et al. (2021) found that 19% of galactagogue users had used domperidone compared to 1% with metoclopramide. This study also found that of all the herbal and pharmaceutical galactagogues, domperidone was perceived to be most effective, with an average rating of 'moderate' to 'very useful' at increasing milk supply. Yet, 45% of users reported having experienced side effects using this medicine. A study by Bazzano et al. (2017) found similar safety concerns. Domperidone was most commonly rated as having neutral safety, and metoclopramide was rated somewhat unsafe. Domperidone was used by 2.7% of respondents, with 20% of those who used it experienced side effects, and only 40% stated they would use it again. Metoclopramide was used by even fewer, at 1.6% and 100% of users experienced side effects. Both

results indicate the negative views associated with pharmaceutical galactagogues and the attitudes that arise after use. In an observational Australian survey-based study by McBride et al. (2022), knowledge and perceived safety of galactagogues was assessed. This found that 69% and 24% of respondents had heard of domperidone and metoclopramide, respectively. Of all galactagogues, metoclopramide was rated as having the lowest perceived safety. 20% and 17% of respondents rated metoclopramide as being either 'somewhat' or 'very unsafe' for mothers and infants, respectively. Comparatively, ginger, brewer's yeast, and lactation cookies had the highest proportion of participants reporting these galactagogues as 'somewhat' or 'very safe'. Grzeskowiak et al. (2015) conducted an Australian observational study on the factors associated with domperidone use. They found that 5% of the sample had been dispensed domperidone by an HCP. Similarly, Jia. (2023) conducted an observational study of BF women in Aotearoa and found that 5% of respondents had used domperidone. In Jia (2023), no metoclopramide users were identified as this is not commonly prescribed for BF in Aotearoa. The data indicates that a small proportion of women use pharmaceutical galactagogues. However, it is important to note that these require a prescription from an HCP and thus may influence use rates as they may be less accessible.

Among herbal galactagogues, fenugreek was the most commonly cited across the literature, ranging from 22% to 100% across various studies (McBride et al., 2021; McBride et al., 2022). Other frequently reported galactagogues included lactation cookies (37–47% usage) (McBride et al., 2021; Ryan et al., 2023), oats (44% usage) (Ryan et al., 2023), brewer's yeast (32% usage) (McBride et al., 2021), and sports drinks (32% usage) (Ryan et al., 2023), as per studies in United States and Australia.

The galactagogues most commonly reported in non-Western countries were grossly different compared to those mentioned above, and variation between countries was also considerable. In China, Shen et al. (2023) reported the most commonly used galactagogues by BF women were crucian carp soup (90%), chicken soup (86%), and pig feet soup (78%). In Thailand, Buntuchai et al. (2017) conducted an observational study on the frequency of consuming galactagogues. They found that the most commonly consumed were (means) gourd, basil, and ginger. In Iran, according to the study

conducted by Molavi Vardanjani et al. (2022) with 483 mothers, lentils were the most commonly reported galactagogue (31%), followed by coffee (26%). Finally, in Malaysia, Tan et al. (2022) reported in their observational study that 66% of galactagogue users had used dates, 58% used oats, and 56% used soya beans to increase milk supply.

The types of galactagogues used by women are highly variable, even within countries. For instance, a cross-sectional study in Ghana highlighted significant differences in types and reasons for galactagogue use between North and South Ghana (Ali et al., 2020). Hence, this list is not comprehensive, and the results are context dependent.

It is important to note the sampling methods of the studies. A large majority of studies on prevalence used sampling methods that recruit convenience samples and thus are likely not truly representative of what is consumed by the wider population. For example, Ryan et al. (2023) highlighted the study's limited ethnic and racial diversity and thus is likely not representative of the true population in the United States. Additionally, some studies relied on women's past experiences to account for the use of galactagogues during BF and, therefore, may lead to recall bias. McBride et al. (2021) included women who were both BF and had been BF in the past, and this included women who had BF as long as 3.9 years ago. This long duration between actual consumption and reporting may elicit errors in over or under-reporting due to the presence of time. These limitations may partly contribute to why we see considerable variation in the prevalence of use.

Table 2.1 Prevalence of the use of types of herbal galactagogues across studies

Galactagogue type / Study	Country of origin	Lactation cookies	Fenugreek	Oats	Brewer's yeast	Fennel	Lactation tea	Blessed thistle	Ginger	Milk thistle	Goats rue	Sports drinks	Combination supplement
(McBride et al., 2021)	Australia	47%	22%	-	32%	8%	-	5%	3%	2%	-	-	-
(Jia, 2023)	New Zealand	71%	17%	10%	-	-	19%	-	-	-	-	-	17%
(Bazzano et al., 2017)	United States	-	45.7%	-	-	16%	-	-	-	12.8%	2.1%	-	-
(Ryan et al., 2023)	United States	37%	9%	44%	15%	-	23%	-	-	-	-	32%	23%
(Sim et al., 2013)	Australia	-	18.4%	-	-	4.9%	-	5.9%	11.8%	-	-	-	-

2.3 Associations with Galactagogue Use

2.3.1 Characteristics of Use/ Reasons for Use of Galactagogues

Gauging the prevalence of the use of galactagogues offers insight into the current environment, but understanding the motivations behind their use holds greater clinical significance. Given the uncertainty surrounding galactagogue efficacy and safety, understanding the primary drivers behind their use may obtain context to better provide women with evidence-based guidance for their use alongside other BF strategies. Many factors contribute to a mother's decision to use galactagogues, as evidenced by qualitative and quantitative research. The subsequent sections will delve into these aspects in detail.

2.3.2 Demographic Characteristics

The literature indicates that users of galactagogues differ demographically from non-users, irrespective of the reason for use. Four observational studies, conducted by Grzeskowiak et al. (2015) (Australia), McBride et al. (2021) (Australia), Ryan et al. (2023) (United States), and Jia (2023) (New Zealand) identified significant demographic characteristic differences between galactagogue users and non-users. These four studies were included due to the similarity in populations and were the primary studies that looked at associations of demographic characteristics with use. Primiparous women were more likely to use galactagogues, 1.9 times more likely as reported by Grzeskowiak et al. (2015), with 56% of users being primiparous, according to McBride et al. (2021), in Jia. (2023)

mothers with more than one child were 1.33 times as likely to use galactagogues, and 66% of users were first-time breast feeders, according to (Ryan et al., 2023). Galactagogue use was more common in women who had undergone a caesarean section birth, with a 1.3 times greater likelihood reported by Grzeskowiak et al. (2015), 38% of users had undergone a caesarean section according to McBride et al. (2021), and 62% of users having undergone a caesarean section compared to 55.8% of non-users in Ryan et al. (2023) . Grzeskowiak et al. (2015) found that the strongest demographic predictor of galactagogue use, specifically domperidone, was preterm birth, with users being 3.5 times more likely to have had a preterm birth. A negative linear relationship was seen between increasing gestational age and use. Furthermore, McBride et al. (2021) reported that 14% of galactagogue users had experienced a preterm birth compared with 9% of non-users (p=0.002). Finally, older maternal age was commonly associated with galactagogue use, with each one-year increase in women's ages, the likelihood of using domperidone increased by 4%, according to Grzeskowiak et al. (2015). Ryan et al. (2023) reported that users on average were 0.6 years older than non-users and Jia (2023) found that higher maternal age was associated with an increased likelihood of galactagogue use.

2.3.3 Perceived Insufficient Milk

The link between perceived insufficient milk in mothers and galactagogue use was identified in the literature as follows.

In Australia, two large-scale observational studies by McBride et al. (2021, 2023) revealed that galactagogue users were more likely to report PIM, with 22% of non-users compared to 68% of users experiencing PIM. A sub-study was conducted on this sample, looking specifically at domperidone use and similar associations were found. 92% of domperidone users reported PIM. Comparatively, 61% of women who did not use domperidone reported PIM (McBride et al., 2023). It is important to note that domperidone is a prescription-only pharmaceutical galactagogue, and HCPs must deem there to be a BF problem to initiate use. Similarly, a cross-sectional study by Millinga et al. (2022) found that BF women reporting low milk supply were more likely to use herbal medicine (25% vs 2.9%). In the

United States, Ryan et al. (2023) observed that reporting PIM increased the likelihood of galactagogue use, with 78.8% of respondents reporting PIM also reporting galactagogue use compared with those without PIM where 53.8% used galactagogues.

Similarly, a cross-sectional study in Cape Town, South Africa, identified a significant association between PIM and galactagogue use (p=0.013). Of those who used galactagogues, 64% of women were provided with BF advice before use. This study also found that the most commonly reported reason for the use of formula feeds was the perception of inadequate breast milk, further highlighting the impact of PIM on BF outcomes (Steyn et al., 2017). The reasons for galactagogue use vary across populations, but research suggests that concerns about breast milk production are a prime motivator for use. A recent follow-up observational study in China looking at EBF, galactagogue consumption, and PIM in 218 participants found that 63.1% of galactagogue users cited the belief that it would increase milk supply as their reason for use. Yet, there was no significant association between use and PIM. Galactagogues may be used as prevention over treatment in this population (Shen et al., 2023). The single more prevalent reason for use was that a caregiver had prepared it. Similarly, an Iranian study investigating the use of Traditional, Complementary and Integrative Medicine (TCIM) found that 97.1% of the population used any TCIM product, and 66.4% used galactagogues to induce lactation, potentially indicating a preventative rather than reactive approach to addressing milk production concerns (Molavi Vardanjani et al., 2022). This behaviour may be seen less commonly in Aotearoa/ Australia, where specific foods eaten for BF may be less engrained in the tradition.

Qualitative evidence further supports the influence of milk production perceptions on galactagogue use. One Australian study carried out semi-structured interviews with BF women and identified all reasons related to galactagogue initiation. These could be classified into core domains and wider dimensions, and the one common trigger was women's concerns about breast milk quality or quantity (Zizzo et al., 2021). An earlier Australian study by Sim et al. (2014) indicated that PIM was the most common reason for galactagogue use, followed by clinically diagnosed insufficient milk production. Reporting of PIM as a reason for galactagogue use was also seen by Barnes et al. (2019). Consistency

across the data, specifically in Australian populations, indicates a potential theme and may be similar to what is seen in Aotearoa, given the cultural similarity.

Although these studies indicate the potential association between galactagogue use and the reporting of PIM by BF mothers, it is important to note that no studies examined the timing between these two factors. The identification of galactagogues use preceding or following PIM was not indicated in any of the above studies, making it difficult to understand if PIM was the reason for use, occurred alongside use, or PIM began after initiation. There is also little research indicating if the use of galactagogues helped with mother perceived effects of milk supply.

2.3.4 Cultural Use

The reasons for using galactagogues vary across populations. Using galactagogues to aid with milk supply and its relationship with PIM has been outlined above. However, the literature often indicates that use of galactagogues also often reflects cultural norms and traditions. Across non-Western cultures, galactagogue use is deeply rooted in tradition (Ali et al., 2020; Buntuchai et al., 2017; Chao et al., 2020; Jendras et al., 2020; Shen et al., 2023). For instance, Ali et al. (2020) conducted a cross-sectional study in Ghana, and this identified 70.4% of women believed they had adequate breast milk, yet 83.8% were galactagogues users. 67.7% of users stated the reason for use was to enhance breast milk production, followed by according to tradition (25.1%), emphasising the culturally significant and societal norm of these practices. Family members, specifically parents (31.6%) and grandparents (24.6%), play an important role in recommending these substances, further highlighting the influence of cultural traditions. Notably, this study looked at both the northern and Brong-Ahafo regions; results were presented as a summation and as separate regions, and there are differences between these. Tradition was the most common answer for use in the Brong-Ahafo region (49.1%) versus enhancing milk production in the Northern region (88.5%), indicating differences even within countries, and highlighting that galactagogue use is highly multifactorial.

Similarly, a 2023 study in China involved 218 postpartum women aged 18-45 with infants less than 1 week of age, who were followed for four months post-birth. This examined consumption patterns of galactagogue foods and their association with PIM and EBF. Galactagogues prepared by a caregiver for the BF women were the reason for use in 68.09% of respondents, and traditional dietary culture accounted for 21.99% of use (Shen et al., 2023). Interestingly, research from Western countries found that mothers of Asian background were more likely to use galactagogues (Sim et al., 2013), indicating the strong influence of culture outside their country of origin. Overall, these results reflect that the literature suggests that belief in the health properties of food is a driving force for the consumption of galactagogues, among other herbal medicines, particularly in Southeast Asia (Tan et al., 2022; Withers et al., 2018).

2.4 Initiation and Duration of Use

Waning breast milk supply is the proposed indication for the use of pharmaceutical galactagogues in postpartum women; however, due to the lack of efficacy evidence, there are no clear guidelines on the initiation and duration of use (Drugs and Lactation Database (LactMed®)). Given this, this literature review will investigate how women are currently using galactagogues and when they begin this initiation during BF.

Observational studies provide insight into when women use these substances. One study examined using special foods and herbs to increase milk production in Ghana. This found that often, these substances were used prophylactically during pregnancy (11.4%) and were most commonly started in the second trimester of pregnancy (47.8%) (Ali et al., 2020). During BF, initiation of galactagogues ranges from within the first week postpartum to as late as seven months postpartum (McBride et al., 2023; McBride et al., 2021; Sim et al., 2014). McBride et al. (2021), in a cross-sectional study of Australian women, found that 18.5% of women began using as early as one week postpartum. This then increased to 50% of women after four weeks. Shen et al. (2014) found that up to 65% of women

in China who were four weeks postpartum were using galactagogue products. Duration of use is uncommonly investigated. The same Australian study from 2021 looked at lengths of use for specific galactagogues. They found the median duration for current users of galactagogues ranged from six weeks (milk thistle) to 19 weeks (ginger). This differed from women who had used galactagogues in the past; median durations ranged from two weeks (ginger) to seven weeks (combination of herbs) (McBride et al., 2021). These differences indicate the potential for bias in reporting, given current and previous users had varied results. This sample population was used for a second study that looked specifically at the use of domperidone and the duration of use in women was one week to one year (median= six weeks). There was further variation depending on the dose that had been prescribed; the median duration for >61mg/day was 20 weeks, compared to the median duration for <30mg/day, which was four and a half weeks (McBride et al., 2023). This is important clinically as there is concern that doses >30mg/day may increase the risk of cardiac arrhythmias and sudden cardiac death (Drugs and Lactation Database (LactMed®)). Yet this group reported using it for more extended periods. An earlier study conducted in Australia used interview methods to qualitatively investigate the use of galactagogues in a sample population of 20 participants. This found women stated they used galactagogues for one week up to nine months during BF (Sim et al., 2013). However, it is important to note that this is a very small sample size, and the frequency of use was not investigated. Thus, it should be looked at with caution. Regardless, overall, this indicates the variation in when and how long galactagogues are used.

2.5 Measuring Galactagogue Use

Researchers have used a variety of questions to address and evaluate the use of galactagogues and all the elements surrounding this topic. This makes comparison of results difficult. The wording of the question relating to the use of galactagogues by BF women is relevant to the thesis, and thus, this review will focus on this. How studies included PIM or milk supply in their question will also be

examined. This is important as the definition of PIM can consist of mothers' perceptions of the quality and quantity of milk, which are important aspects of milk supply.

Shen et al. (2023) looked at the use of galactagogues and their association with PIM and BF duration and used several questionnaires to collect data in an observational study. This included a pilot-validated galactagogue questionnaire to understand the types and frequency of galactagogue foods consumed in a month. They asked participants to report if, in the past month, they had consumed any of the 24 identified traditional galactagogues. However, the question did not specify if these foods were consumed with the intent of wanting to increase milk supply. This omission had possibly led to overestimating the use of galactagogues to increase milk supply or support BF. These foods were possibly been consumed out of habit or already included in the diet before starting BF and thus are less relevant in this context. Two Australian studies used the same questionnaire types to look at the use of herbal and pharmacological galactagogues. Participants were asked, "Did you use any medicines/ substances to increase breast milk supply?". This was followed by "Following the birth of your youngest infant, did you ever take any of the following to boost milk supply" (McBride et al., 2023; McBride et al., 2021). This wording addresses the weakness of the wording in Shen et al. (2023), as the study included the reason behind the use of galactagogues in the question. This is a strength in as it relates consumption with BF, specifically milk supply. However, the word 'supply' was not further distinguished to include quality and quantity. Women are left to interpret what supply means to them and, therefore, may miss a portion of women who may have used galactagogues to address milk quality as they may not associate supply with quality. A Southeast Asian study used similar wording, listing a range of identified galactagogues and asking if participants had 'heard of it as a milk booster', 'used as a milk booster', or 'never heard of and never used as a milk booster' (Tan et al., 2022). Including the context in the question ensures that the intent of consumption is clear, which is a strength of the questionnaire. However, the word 'booster' does not directly address supply- quality or quantity and is left to interpretation by the participant. This may have limited the study in associating use with perceived milk supply as this is not directly being asked about. No association

between PIM and galactagogue use was found, but there may be an association if underreporting occurred due to the question's wording. Sim et al. (2013), in an Australian study, and Ryan et al. (2023) in a United States study used the same question in their studies. Participants responded yes/no to the question, “Have you used any foods or beverages, a combination supplement, any herbal supplement in isolation, or any pharmaceuticals to increase your milk supply?”. It then asked participants to indicate which of the 20 galactagogues they had used. Galactagogues were listed randomly to reduce bias, and 'other' galactagogues were provided as an option, both strengths of this question. However, supply is not defined as quality or quantity and thus does not encapsulate the whole meaning of PIM. Millinga et al. (2022) used the same questionnaire translated to Swahili in their study. (Lawrence & Lawrence, 2016). Two studies remained vague in questioning, only stating, “Do you use galactagogues?” (Ali et al., 2020; Steyn et al., 2017), and one study provided no information on the wording or any specifics on the questionnaire (Abdul Ghani et al., 2020). The use of the word galactagogues in the question may be a limitation as many women may not know what this refers to, i.e., it is a scientific term. This may elicit underreporting as women are not clear on what galactagogues are and how they relate to BF. It is difficult to comment on the strengths or limitations of these three studies as the specifics are unclear. However, not detailing the question is a limitation in itself, as we cannot be sure that the results reflect what is being described.

Critique of the current literature and how studies have asked about the use of galactagogues and their relationship to PIM should be used when developing a survey of BF women. The research indicates that it is beneficial to remain vague or use lay terms when describing galactagogue. This allows women to interpret these substances as they deem relevant in the context of BF, such as that used in Ryan et al. (2023). It would also be crucial to relate the use of these substances to the women’s intent of consuming the food. Consuming these foods to support BF or increase supply ensures that this consumption is not incidental, or a pre-existing behaviour and is beneficial when associating use with PIM. Concerning the wording of PIM it would be important to include both the words quality and quantity, given that this encapsulates the full definition of PIM. This is something that has not yet been

done in the literature. Finally, the responses to the question regarding galactagogue use should list the possible options in random order. It would also be necessary to include an 'other' option to capture all women and how use may vary .

2.6 Conclusion

Breast milk is the ideal infant food for the first six months of an infant's life, and continued consumption for the following 24 months is optimal. Adherence requires successful BF from both mother and infant. Many factors influence BF outcomes, of which PIM is a significant influence. Despite increasing BF frequency being the recommended strategy to increase milk supply, many women turn to alternative ways to aid in this difficulty, most notably using galactagogues. Galactagogues are herbal or pharmacological substances used to support BF, yet evidence of their safety and efficacy is limited. The extent of the use of galactagogues in Aotearoa is still largely unknown. This study focuses on understanding the prevalence of galactagogue use in a sample BF women in Aotearoa and exploring some of the associations mentioned in this literature review.

Chapter Three: Manuscript- Use of galactagogues and its association with maternal characteristics in breastfeeding women in Aotearoa

3.0 Abstract

Background: Galactagogues are herbal, food, or pharmaceutical substances increasingly used to enhance breast milk production in breastfeeding women. Literature has associated galactagogue use with perceived insufficient milk; a mother's belief that their quality or quantity is insufficient to meet infant needs. However, evidence of galactagogue efficacy remains limited. The aim of this thesis is to describe the use, type, duration, and purpose of galactagogue use by breastfeeding women in Aotearoa, understand the factors associated with use, and examine links to perceived insufficient milk.

Methods: A quantitative cross-sectional online survey was distributed via study advertisements on Facebook, the Le Leche League, Lactation Consultants, or by word of mouth. Women currently breastfeeding, or who breastfed in the past year, aged 16+ in Aotearoa, were eligible. The data were analysed using descriptive statistics and bivariate and logistic analyses.

Results: In total, 763 women were included in this study. More than half the participants (63.8%) reported using a galactagogue. The most commonly reported galactagogues were oats (71.1%), followed by lactation cookies (59.3%) and nuts and seeds (42.1%). Bivariate analyses found galactagogue use was higher among primiparous women (68.8% vs 57.6%, p=0.001), those with caesarean births (70.4% vs 60.4%, p=0.010), having previously used galactagogues (yes=69% vs no=30.3%, p<0.001), those concerned with perceived insufficient milk quantity (44% vs 78%, p<0.001), and perceived insufficient milk quality (54% vs 75.4%, p<0.001). Multivariate analysis found perceived insufficient milk quantity was the only predictor of galactagogue use. Many women who never reported perceived insufficient milk quantity (54%) or quality (44%) still reported galactagogue use. The most common reason for using galactagogues was to increase milk supply (47.9%). Nearly two-thirds of women (60.5%) commenced galactagogue use within the first four weeks postpartum. Using a galactagogue for less than one week was uncommon.

Conclusion: This study revealed that galactagogue use was high among breastfeeding women in Aotearoa. Mothers concerned about perceived insufficient milk quantity or quality were more likely to use galactagogues, yet a significant proportion of mothers who never questioned these aspects. Qualitative research is needed to clarify decision making processes and influences.

3.1 Introduction

Exclusive breastfeeding (EBF), when an infant receives only breast milk from their mother, is recommended to be initiated within the first hour of life and should continue to be the infant's sole source of nutrition for the first six months. Breastfeeding (BF) should be continued alongside complementary feeding until 24 months of age (Ministry of Health, 2021; World Health Organization, 2015). These recommendations were established to reflect the extensive research identifying the benefits of BF. For the infant, these include; reduced risk of infant mortality, protective effects against Sudden Infant Death Syndrome (SIDS), type 2 diabetes, obesity and asthma in adolescence (Fewtrell, 2004; Hauck et al., 2011; Horta & de Lima, 2019; Horta & Victora, 2013; Leon-Cava et al., 2002; Qiao et al., 2020; Xue et al., 2021). For the BF mother, these include reduced risk of breast and ovarian carcinoma, type 2 diabetes, hypertension and a range of cardiovascular diseases, as well as positive economic and psychological impacts (Chowdhury et al., 2015; Kuma, 2015; Tschiderer et al., 2022). Yet, in Aotearoa, the most recent health survey data indicated that only 9.5% of infants were EBF till six months (Ministry of Health, 2022).

Research has shown a range of reasons why the recommended EBF for infants is not carried through until six months. BF is not an easy task for many mothers; breast and nipple pain, engorgement, maternal fatigue, ineffective latch, and poor weight gain are common BF experiences that can lead to premature cessation (Gianni et al., 2019; Mahurin-Smith, 2023; Morrison et al., 2019; Scime et al., 2023). Of most importance to this thesis is perceived insufficient milk production. Perceived Insufficient Milk (PIM) is the self-reported subjective perception of insufficient milk from the mother (Hill & Humenick, 1989). This thesis considered perceptions of insufficient breast milk quantity or

quality by BF mothers to be classified as PIM. The incidence of PIM is estimated to be 10–25% of mothers globally and was commonly reported as the reason for cessation at different stages throughout BF (Huang et al., 2022). Actual Insufficient Milk (AIM) is diagnosed when the mother physically cannot produce enough milk for the infant (Lee & Kelleher, 2016). AIM is more challenging to quantify and assess and therefore is almost always reported or referenced in combination with the incidence of PIM.

PIM is one commonly cited reason for the cessation of BF, but many issues can arise. Although prevalence rates of women experiencing issues leading to early cessation are not well understood, issues such as breast and nipple pain are well-acknowledged causes (Gianni et al., 2019; Morrison et al., 2019). These issues can be overcome in most cases, and women can continue BF when managed effectively (Lawrence & Lawrence, 2016). Increasing effective feed frequency, having support with latch technique, and correct positioning are supported strategies for managing BF recommended by Health Care Professionals (HCPs) and should be first-line treatment (Lawrence & Lawrence, 2016). However, given the range of difficulties that can arise for many mothers throughout BF, it is not unexpected that this population may also seek alternative solutions to remedy these troubles. Galactagogues are one possible way to address issues such as insufficient breast milk but are recommended to be taken alongside the gold standard BF management techniques rather than used in isolation (Forinash et al., 2012; Gabay, 2002; Kent et al., 2012).

Galactagogues are substances defined as food or medicines that are consumed with the intent to support BF. Specifically, they are proposed to increase milk production (Foong et al., 2020). These substances come in various forms, from pharmaceuticals to herbal preparations to foods. Research on the efficacy of these substances is limited. There is reasonably strong evidence for some specific pharmaceutical forms, e.g., domperidone, indicating there may be positive effects for increasing expressed breast milk volume for preterm infant mothers, but the effects in term infant mothers are more contested (Bazzano et al., 2016a; Donovan & Buchanan, 2012; Shen et al., 2021).

Research on the efficacy and effectiveness of herbal and food galactagogues is far more limited (Penagos Tabares et al., 2014). Kwan & Abdul-Rahman et al. (2021) scoping review of 13 herbal types, including fennel, fenugreek, and milk thistle, among others, found common trends in increases in milk production after use. However, overall, the quality of evidence is low, with many limitations, including the lack of effects they had on women's prolactin levels despite this being the proposed mechanism for effect.

Previous studies report the use of a wide range of galactagogues that vary across populations. Studies in the United States, Malaysia, South Africa, Aotearoa, and Australia indicate that the use of galactagogues may range from 54% to 91.7% of BF women (Jia, 2023; McBride et al., 2021; Molavi Vardanjani et al., 2022; Ryan et al., 2023; Steyn et al., 2017; Tan et al., 2022). Of important note, all studies used different sampling methods, and none had a true random population sample. Commonly cited galactagogues include domperidone and metoclopramide, fenugreek, lactation cookies, oats, brewer's yeast, and sports drinks (Bazzano et al., 2016a; McBride et al., 2023; McBride et al., 2021; Ryan et al., 2023).

The use of galactagogues to aid milk production is more common in specific groups of BF women. Research has shown more common use among primiparous women, women who had caesarean section or preterm birth, and are older. Both qualitative and quantitative research indicate that there seems to be a link between PIM and galactagogue use (Grzeskowiak et al., 2015; Jia, 2023; McBride et al., 2023; McBride et al., 2021; Millinga et al., 2022; Ryan et al., 2023; Steyn et al., 2017; Zizzo et al., 2021).

Research has investigated additional aspects of BF and galactagogue use, including reasons for use, timing, and duration. Reasons for use vary but are primarily related to inducing or promoting milk production, concerns about insufficient breast milk, or cultural practices (Ali et al., 2020; Molavi Vardanjani et al., 2022; Shen et al., 2023; Sim et al., 2014; Sim et al., 2013). The initiation of use ranges from as early as one week up to seven months postpartum (McBride et al., 2023; McBride et al., 2021; Sim et al., 2014). Duration of use is significantly varied, ranging from one week to one year (McBride

et al., 2023; McBride et al., 2021). Overall, much of this evidence has limitations or details of the data collection were not reported, making it difficult to compare between studies.

Only one previous small study was conducted in Aotearoa (Jia, 2023); thus, its use in the wider population is poorly understood. The current investigation aims to understand the prevalence of galactagogue use in a sample of BF women in Aotearoa, identify common types used, initiation and duration of use, and understand characteristic associations. Findings will provide a better understanding of galactagogue use in Aotearoa and provide HCPs with an awareness of what is consumed in this population.

3.2 Methodology

3.2.1 Participants and Setting

This was a cross-sectional, observational study using an online questionnaire. The targeted respondents were women currently BF or had breastfed in the past year, living in Aotearoa for all or some of the time they were BF and over 16 years of age. The recruiting procedures were as follows: advertisements were displayed on Facebook, the Le Leche League Newsletter, through Lactation Consultants, or by word of mouth (Appendix A). An information sheet (Appendix B) was then accessed through the QR code on the advertisements, and women who wished to participate accessed the online questionnaire through a link on the information sheet. The first question asked participants for consent, which was required to proceed to the survey. This study was approved by Massey University Human Ethics Committee Ohu Matatika 1, Application OM1 23/54 (Appendix C).

3.2.2 Data Collection and Variable Definition

Data collection was conducted between July and August 2024. The questionnaire development included input and review from experts in the field, pre-testing with the relevant population, and cognitive interviews with participants to ensure what was being was understood accurately (Balza et al., 2022). The questionnaire included 58 questions (Appendix D), both closed and open-ended. Some

closed questions included the “other” option so respondents could describe their experience if this was not included in the provided options. Questions were categorised as infant feeding (22 questions), milk quantity and quality (six questions), galactagogue use (eight questions), BF experience (two questions), birth information (eight questions), and demographics (11 questions). Participants were not obliged to answer every question but were notified when they progressed through the survey with an unanswered question. All feeding history questions were based on the participant's BF experience with their youngest infant. ‘Currently BF’ also includes women who were expressing milk. Participants were asked, “Since the birth of your baby/ youngest child, did you eat or drink anything with the purpose of supporting breastfeeding or influencing your milk supply or milk quality? For example, medications, supplements, herbs/herbal products, foods/drinks or Rongoa”. If yes, they were considered galactagogue users and selected from a range of substances women in the literature have identified as galactagogues or state ‘other’.

Women were asked two questions related to perceived insufficient milk. PIM variable formation included both quantity (PIM quantity) and quality (PIM quality). One question asked if mothers believed their milk quantity was enough; women who answered ‘No, I made too much milk’ and ‘Yes, once or twice I thought that my supply was not enough’ were considered not to have PIM quantity. Women who answered ‘Yes, there were periods I worried my milk supply was not enough’ or ‘Yes, I always worry about my supply not being enough’ were considered to report PIM quantity. The second question asked participants if they ever questioned their milk quality not being good enough. Participants who answered ‘no, never’ or ‘once or twice’ were considered as not reporting PIM quality. Participants who responded ‘sometimes’, ‘often’, or ‘always’ were considered to report PIM quality.

Association of milk quantity (PIM quantity) and milk quality (PIM quality) with galactagogue use were completed with collapsed groups; ever questioned milk supply (once or twice, periods of time, always) versus never questioned milk supply (made excess or enough), and ever questioned milk quality (once or twice, sometimes, often, always) versus never questioned milk quality.

Ethnicity data was collapsed in for ease of reading. Pacific Island included Samoan, Tongan, Niuean, and Cook Islands Māori, and Asian included Chinese and Indian.

Collapsed variables used in the logistic regression include and are defined as; maternal education level classified as Trade certificate/ Diploma or lower and Bachelor's degree or higher, and household gross income classified as <$80,000 year or >$80,001.

Respondents were excluded from the final analysis based on the following criteria: provided no demographic data, potential bots as determined by Qualtrics reCAPTCHA score based on interactions with the site, or duplicate respondents determined using reCAPTCHA relevant duplicate score ≥75.

3.2.3 Statistical Analysis

All data were analysed using SPSS version 29. Continuous data were checked for normality (Kolmogorov-Smirnov and Shapiro-Wilk test) and expressed as mean and standard deviation (SD) and categorical data as frequencies (%). Bivariate analyses (Mann-Whitney test and Pearson Chi-Square) were performed to analyse the associations between galactagogue use and maternal socioeconomic and birth-related characteristics. Independent variables with $p<0.05$ were considered to have a significant association.

One logistic analysis was completed on these data. The variables for this model were based on what was indicated in the literature to predict galactagogue use (Grzeskowiak et al., 2015; Jia, 2023; McBride et al., 2023; McBride et al., 2021; Millinga et al., 2022; Ryan et al., 2023; Steyn et al., 2017), as well as significance from bivariate analysis of this sample. The logistic regression model included variables: infant born via caesarean section, infant was born preterm, mother-infant skin-to-skin in the first 30 minutes, mother and infant were separated in the first-week post-birth, parity (primiparous vs multiparous), maternal age, mother questioned milk quantity, mother questioned milk quality, maternal education level, and household gross income, and 'prefer not to say' was excluded from the variable in this multivariate analysis model.

3.3 Results

3.3.1 Participant Characteristics

Seven-hundred and sixty-three BF women aged 19–54 years were included in the final analysis. Eighty-five women were excluded from the analysis. The most common reason for the exclusion of a participant was due to no demographic data being provided. Participant characteristics are presented in **Table 3.1.** The median age of women at delivery was 32 years. Most women in this study classified themselves as NZ European (81.7%). 9% of women classified their ethnicity as Māori. 15.9% of women classified themselves with 'other' as their ethnicity, which specified 39 different ethnicities. Commonly reported ethnicities in this range included; South African, American, Filipino and French. More than half of the women had an education level of a bachelor's degree or higher (65.6%). Nearly half the population had a gross annual household income of >$120,001 (47.3%). One-third of women delivered their infants via caesarean section (31.5%), and the majority of infants were born full term (96.6%).

3.3.2 Comparisons of Galactagogue Use by Maternal Characteristics

Results of the bivariate analyses between galactagogue use and maternal demographic and birth characteristics are presented in **Table 3.1**. several associations were found between characteristics of BF mothers and galactagogue use. Mothers who reported galactagogue use were more likely to be primiparous than multiparous. Likewise, reported galactagogue use was significantly more likely in women who had previously used galactagogues than those who had never. Galactagogue use was higher among women who had a caesarean birth but did not differ based on preterm birth. Use did not differ by maternal age, education level, gross household income, infant gender, birth weight, skin-to-skin contact within 30 minutes post birth, or if the mother and infant were separated in the first-week post-birth.

Galactagogue use was significantly associated with mothers' perceived milk quantity and quality. Use was more common in mothers who were concerned about PIM quantity and likewise with mothers who were concerned about PIM quality.

Table 3.1 Bivariate analysis of maternal characteristics according to any reported use of galactagogues by breastfeeding women in Aotearoa

	Total survey population	Did not use galactagogues	Used a galactagogue	*p*-value[†]
	n (%)	n (%)	n (%)	
Total sample population	763	276 (36.2)	487 (63.8)	-
Mothers age at delivery[§] (n=754)	32.0 (4.5)	32.2 (4.5)	31.9 (4.4)	0.416
Race/ Ethnicity (n=760)[‡]				
New Zealand European	623 (81.7)	232 (37.3)	391 (62.7)	
Māori	69 (9.0)	20 (29.0)	49 (71.0)	
Pacific Island	13 (1.7)	2 (15.4)	11 (84.6)	
Asian	29 (3.8)	10 (34.5)	19 (65.5)	
Other	121 (15.9)	39 (32.2)	82 (67.8)	
Education level (n=758)				0.813
No secondary school qualification	10 (1.3)	4 (40)	6 (60)	
Secondary school qualification or NCEA 1–3 or NZQF 1–4	150 (19.7)	51 (34.0)	99 (66.0)	
Diploma or trade certificate	97 (12.7)	36 (37.1)	61 (62.9)	
Bachelor's degree or NZQF level 7 qualification	301 (39.4)	105 (34.9)	196 (65.1)	
Higher degrees (i.e., masters)	200 (26.2)	79 (39.5)	121 (60.5)	
Gross annual household income (n=759)				0.913
Up to $20,000	7 (0.9)	3 (42.8)	4 (57.1)	
$20,001–$50,000	28 (3.7)	10 (35.7)	18 (64.3)	
$50,001–$80,000	89 (11.7)	36 (40.4)	53 (59.6)	
$80,001–$120,000	214 (28.0)	79 (36.9)	135 (63.1)	
>$120,001	361 (47.3)	128 (35.5)	233 (64.5)	
Prefer not to say	60 (7.9)	19 (31.7)	41 (68.3)	
Currently breastfeeding (n=763)				
Yes	678 (88.9)	244 (36.0)	434 (64.0)	
No	85 (11.1)	32 (37.6)	53 (62.4)	
Parity				0.001
Primiparous	423 (55.4)	132 (31.2)	291 (68.8)	
Multiparous	340 (44.6)	144 (42.4)	196 (57.6)	
Previous galactagogue use (n=327)				<0.001
Yes	184 (56.3)	57 (31.0)	127 (69.0)	
No	135 (41.3)	82 (60.8)	53 (39.3)	
Can't remember	8 (2.4)	1 (12.5)	7 (87.5)	
Infant characteristics				
Infant age (n=761)				
0–5 months	439 (57.5)			
6–11 months	137 (18.0)			

	Total survey population	Did not use galactagogues	Used a galactagogue	*p*-value[†]
	n (%)	n (%)	n (%)	
12–23 months	130 (17.0)			
>24 months	55 (7.2)			
Infant Gender (n=763)				0.921
Female	392 (51.4)	141 (36.0)	251 (64.0)	
Male	369 (48.4)	134 (36.3)	235 (63.7)	
Intersex	0 (0)	0 (0)	0 (0)	
Prefer not to say	2 (0.3)	1 (50)	1 (50)	
Infant birth weight (grams; mean +/- SD) (n=684)	3382.3 (887.7)	3434.1 (823.0)	3352.3 (922.2)	0.550
Birth Characteristics				
Preterm birth (born before 36 weeks) (n= 763)				0.318
Yes	26 (3.4)	7 (26.9)	19 (73.0)	
No	737 (96.6)	269 (36.5)	468 (63.5)	
Caesarean section (n=763)				0.010
Yes	240 (31.5)	71 (29.6)	169 (70.4)	
No	523 (68.5)	205 (39.2)	318 (60.8)	
Skin-to-skin in first 30 minutes post birth (n=763)				0.090
Yes	611 (80.1)	230 (37.6)	381 (62.4)	
No	152 (19.9)	46 (30.3)	106 (69.7)	
Infant/ mother separated in first week (n= 763)				0.060
Yes	119 (15.6)	34 (28.6)	85 (71.3)	
No	644 (84.4)	242 (37.6)	402 (62.4)	

*numbers are total value (% sub sample) unless stated otherwise

[†]Significant differences between the galactagogue users and no users ($p<0.05$) (Mann-Whitney test and Pearson Chi Square)

[§]Age values provided as (years; mean+/-SD)

[‡]Total sample ethnicity values sum to more than 100% as participants could select to identify as more than one ethnicity

Results of the multivariate logistic regression are presented in **Table 3.2.** Reporting PIM quantity was the only variable that predicted galactagogue use.

Table 3.2 Multivariate Logistic Regression associations of galactagogue use with maternal and demographic characters and perceived insufficient milk in Aotearoa breastfeeding women

Model		Unstandardised B	Coefficients Standard error	Standardised coefficient Beta	Significance
1	(Constant)	1.264	0.285		<0.001
	Education level	-0.010	0.040	-0.010	0.800
	Income level	0.094	0.048	0.074	0.054
	Parity	-0.040	0.037	-0.041	0.277
	Maternal age	-0.003	0.004	-0.025	0.536
	Skin to skin in 30 minutes	0.024	0.045	0.020	0.591
	Caesarean section	-0.067	0.038	-0.065	0.074
	Preterm birth	0.055	0.106	0.019	0.606
	Mother-infant separation	-0.027	0.052	-0.020	0.596
	PIM quantity	0.114	0.016	0.297	<0.001
	PIM quality	0.027	0.017	0.065	0.120

3.3.3 Milk Quantity and Quality Perceptions

Mothers milk quality and quality perceptions are presented in **Table 3.3.** More than half the mothers reported perceiving their milk quantity to be insufficient. Nearly half of the mothers reported perceiving their milk quality to be insufficient. Several significant associations were shown. Mothers reporting PIM quantity and PIM quality were more likely to use galactagogues. Fifty-four percent of mothers who never reported PIM quality and 44% who never reported PIM quantity still used a galactagogue.

Table 3.3 Bivariate analysis between galactagogue use and the association with perceived insufficient milk quantity and quality in Aotearoa breastfeeding women

	Total survey population n (%)	Did not use galactagogues n (%)	Used a galactagogue n (%)	*p*-value
PIM quantity (n=763)				<0.001
Made excess milk	105 (13.8)	57 (54.3)	48 (45.7)	
Made enough milk	213 (27.9)	121 (56.8)	92 (43.2)	
Questioned supply once or twice	162 (21.2)	46 (28.4)	116 (71.6)	
Questioned supply for periods of time	187 (24.5)	42 (22.5)	145 (77.5)	
Always questioned supply	96 (12.6)	10 (10.4)	86 (89.6)	
PIM quality (n=762)				<0.001
Never questioned quality	408 (53.5)	189 (46.3)	219 (53.7)	
Questioned quality once or twice	154 (20.2)	40 (26.0)	114 (74.0)	
Questioned quality sometimes	109 (14.3)	29 (26.6)	80 (73.4)	
Questioned quality often	63 (8.3)	11 (17.5)	52 (82.5)	
Questioned quality always	28 (3.7)	7 (0.25)	21 (0.75)	

3.3.3 Prevalence of Use of Galactagogues

Prevalence of the use of galactagogues, and the types of galactagogues used by BF mothers is reported in **Table 3.4**. The most commonly reported galactagogue was oats, followed by lactation cookies, nuts and seeds, breastfeeding/lactation tea, yeast products, and fenugreek. Participants were asked to specify types of 'other' foods they consumed to support BF. The most commonly cited items were all beverages: water, electrolytes, and lactation hot chocolate (Mammas Milk Bar, 2024). No participants reported using Rongoā. The maximum number of galactagogues used was 13, with a mean of 3.27 (SD= 1.91) per user.

Table 3.4 Types of galactagogues used by breastfeeding women in Aotearoa

	Took substance n (%)	Took only this substance n (%)	Took multiple substances n (%)
Total galactagogue use (n=763)	487 (63.8)	85 (11.1)	402 (82.5)
galactagogue type (n=487)			
Breastfeeding/ lactation tea	157 (32.2)	11 (7.0)	146 (93.0)
Lactation cookies	289 (59.3)	25 (8.7)	264 (91.3)
Complan	11 (2.3)	0	11 (100)
Yeast products	156 (32.0)	2 (1.3)	154 (98.7)
Fenugreek	149 (30.6)	6 (4.0)	143 (96.0)
Blessed thistle	19 (3.9)	0 (0)	19 (100)
Milk thistle	13 (2.7)	0 (0)	13 (100)
Fennel	58 (11.9)	0 (0)	58 (100)
Oats	349 (71.7)	17 (4.9)	332 (95.1)
Nuts and seeds	205 (42.1)	3 (1.5)	202 (98.5)
Domperidone	52 (10.7)	2 (3.8)	50 (96.2)
Naturopath and/ or homeopath remedies OTC	18 (3.7)	1 (0.6)	17 (9.4)
Naturopath and/ or homeopath remedies prescribed by a practitioner	6 (1.2)	0 (0)	6 (100)
Other commercial herbal products containing 2+ herbs	42 (8.6)	5 (12.5)	37 (87.5)
Rongoā	0 (0)	0 (0)	0 (0)
Other	83 (17.0)	14 (16.9)	69 (83.1)

3.3.4 Reasons for Galactagogue Use

Reported reasons for galactagogue use are presented in **Table 3.5.** Nearly half of the users reported using the specific galactagogues to 'increase milk supply', followed by consuming these foods in 'general support of BF'. Herbal and yeast products were more commonly used to 'increase milk supply' (yeast products; 57.6% fenugreek; 75.8%, blessed thistle; 84.2%, milk thistle; 69.2%, fennel; 69%)

compared with commercial products/ common dietary foods that were taken to ‘support BF generally’ (breastfeeding/ lactation tea; 38.9%, lactation cookies; 41.1%, oats; 44.1%, nuts and seeds; 47.5%).

Table 3.5 Reasons for the use of galactagogue types by breastfeeding women in Aotearoa

Reason for use	General support of breastfeeding n (%)	To encourage my milk to come in n (%)	To increase my milk supply n (%)	To improve my milk quality n (%)	To give me more energy n (%)	To help me relax n (%)	Other n (%)
Galactagogue type							
Breastfeeding/ lactation tea (n=157)	61 (38.9)	9 (5.7)	60 (38.2)	13 (8.3)	0 (0)	11 (7.0)	3 (1.9)
Lactation cookies (n=287)	118 (41.1)	15 (5.2)	111 (38.7)	10 (3.5)	17 (5.9)	3 (1.0)	13 (4.5)
Complan (n=10)*	2 (20.0)	0 (0)	3 (30.0)	2 (20.0)	2 (20.0)	0 (0)	1 (10.0)
Yeast products (n=151)*	42 (27.8)	8 (5.3)	87 (57.6)	10 (6.6)	2 (1.3)	0 (0)	2 (1.3)
Fenugreek (n=149)	26 (1.7)	6 (4.0)	113 (75.8)	2 (1.3)	1 (0.67)	0 (0)	1 (0.67)
Blessed thistle (n=19)	2 (10.5)	1 (5.3)	16 (84.2)	0 (0)	0 (0)	0 (0)	0 (0)
Milk thistle (n=13)	3 (23.1)	1 (7.7)	9 (69.2)	0 (0)	0 (0)	0 (0)	0 (0)
Fennel (n=58)	14 (24.1)	1 (1.7)	40 (69.0)	1 (1.7)	0 (0)	2 (3.4)	0 (0)
Oats (n=344)*	152 (44.1)	1 (0.29)	141 (41)	18 (5.2)	28 (8.1)	0 (0)	4 (1.2)
Nuts and seeds (n=202)*	96 (47.5)	1 (0.50)	56 (27.7)	23 (11.4)	24 (11.9)	0 (0)	2 (0.99)
Domperidone (n=52)	1 (1.9)	1 (1.9)	50 (96.2)	0 (0)	0 (0)	0 (0)	0 (0)
Naturopath and/ or homeopath remedies OTC (n=18)	7 (38.9)	0 (0)	7 (38.9)	0 (0)	0 (0)	1 (5.6)	3 (16.7)
Naturopath and/ or homeopath remedies prescribed by a practitioner (n=6)	3 (50.0)	0 (0)	2 (33.3)	0 (0)	1 (16.7)	0 (0)	0 (0)
Other commercial herbal products containing 2+ herbs (n=35)*	4 (11.4)	2 (5.7)	26 (74.3)	1 (2.9)	0 (0)	0 (0)	1 (2.9)
Rongoā (n=0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Other (n=67)*	19 (28.4)	0 (0)	22 (32.9)	9 (13.4)	4 (6)	1 (1.5)	12 (17.9)
Total	550 (35.7%)	46 (2.9%)	743 (47.9%)	89 (5.7%)	79 (5.0%)	18 (1.1%)	42 (2.7%)

*n= values differ from Table 3.4 due to non-responders to this question

3.3.5 Timing of Commencement of Galactagogues

The reported timing of commencement of galactagogue use is presented in **Table 3.6.** The majority of users commenced use within the first four weeks postpartum (60.5%), with 36.7% of them commencing use within the first seven days. The one galactagogue that strayed from this pattern most considerably was domperidone which most women commenced use of between two and four weeks, as opposed to within the first week postpartum.

Table 3.6 Timing of commencement of galactagogues types used by breastfeeding women in Aotearoa

Commencement of use	Before the baby was born n (%)	In the first week after birth n (%)	2–4 weeks-month postpartum n (%)	1–2 months postpartum n (%)	2 or more months postpartum n (%)
Galactagogue type					
Breastfeeding/ Lactation tea (n=157)	6 (3.8)	62 (39.5)	56 (35.7)	13 (8.3)	20 (12.7)
Lactation cookies (n=289)	11 (3.8)	128 (44.3)	102 (35.3)	23 (8.0)	25 (8.7)
Complan (n=10)*	1 (10.0)	4 (40.0)	2 (20.0)	2 (20.0)	1 (10.0)
Yeast products (n=154)*	8 (5.2)	49 (31.2)	55 (35.7)	16 (10.4)	26 (16.8)
Fenugreek (n=149)	2 (1.3)	49 (32.9)	43 (28.9)	27 (18.1)	28 (18.8)
Blessed thistle (n=19)	0 (0)	7 (36.8)	7 (36.8)	3 (15.8)	2 (10.5)
Milk thistle (n=13)	0 (0)	7 (5.4)	3 (23.0)	1 (7.7)	2 (15.4)
Fennel (n=58)	2 (3.4)	20 (34.5)	19 (32.8)	8 (13.8)	9 (15.5)
Oats (n=348)*	95 (27.3)	119 (34.2)	85 (24.4)	22 (6.3)	27 (7.8)
Nuts and seeds (n=202)*	55 (27.2)	63 (31.1)	51 (25.2)	16 (7.9)	17 (8.4)
Domperidone (n=51)*	1 (2.0)	3 (5.9)	22 (43.1)	10 (19.6)	15 (29.4)
Naturopath and/ or homeopath remedies OTC (n=18)	1 (5.6)	8 (44.4)	6 (33.3)	0 (0)	3 (16.7)
Naturopath and/ or homeopath remedies prescribed by a practitioner (n=6)	1 (16.7)	1 (16.7)	0 (0)	1 (16.7)	3 (50.0)
Other commercial herbal products containing 2+ herbs (n=35)*	1 (28.6)	12 (34.3)	16 (45.7)	2 (5.7)	4 (11.4)
Rongoā (n=0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Other (n=69)*	14 (20.3)	21 (30.4)	11 (15.9)	14 (20.3)	9 (13.0)
Total	135 (27.7%)	179 (36.7%)	116 (23.8%)	54 (11.1%)	3 (0.6%)

*n= values differ from Table 3.4 due to non-responders to this question

3.3.6 Duration of Use

The duration of specificl galactagogue use by BF women who used galactagogues is presented in **Table 3.7**. Overall, it was uncommon for women to use a galactagogue for a short period (<one week). Duration of use ranged across the specific types of galactagogues. Of women who used oats, it was

most common to use them from the infant's birth to the time they took this survey. Of women who used lactation cookies, it was most common to use them on and off from birth to the completion of the survey. Because the infants were all different ages at the time of the survey, using galactagogues from birth were different lengths of time for all women. For example, 25 (5.2%) mothers with infants aged between 12–23 months had used at least one galactagogue from the infant's birth to the time they completed the survey.

Table 3.7 Duration of types of galactagogues used by breastfeeding women in Aotearoa

Duration of use	Less than one week	1–2 weeks	>2 weeks– 1 month	>1–3 months	The entire time I was breastfeeding	On and off while breastfeeding
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Galactagogue type						
Breastfeeding/ lactation tea (n=157)	13 (8.3)	22 (14.0)	25 (15.9)	26 (16.6)	29 (18.5)	42 (26.8)
Lactation cookies (n= 287)	37 (12.9)	42 (14.6)	57 (19.9)	46 (16.0)	30 (10.5)	75 (23.1)
Complan (n=10)*	0 (0)	0 (0)	2 (20.0)	2 (20.0)	3 (30.0)	3 (30.0)
Yeast products (n=152)*	9 (5.9)	15 (9.9)	22 (14.5)	19 (12.5)	33 (21.7)	54 (35.5)
Fenugreek (n=149)	14 (9.4)	11 (7.4)	29 (19.5)	30 (20.1)	32 (21.5)	33 (22.1)
Blessed thistle (n=19)	1 (5.3)	3 (15.8)	5 (26.3)	4 (21.1)	4 (21.1)	2 (10.5)
Milk thistle (n=13)	0 (0)	1 (7.7)	4 (30.8)	2 (15.4)	3 (23.1)	3 (23.1)
Fennel (n=57)*	6 (10.5)	8 (14.0)	12 (21.1)	9 (15.8)	7 (12.3)	15 (26.3)
Oats (n= 349)	4 (1.1)	9 (2.6)	16 (4.6)	31 (8.9)	183 (52.4)	106 (30.4)
Nuts and seeds (n=205)	3 (1.5)	6 (2.9)	14 (6.8)	18 (8.8)	105 (51.2)	59 (28.8)
Domperidone (n=52)	1 (1.9)	3 (5.8)	6 (11.5)	19 (36.5)	20 (38.5)	3 (5.8)
Naturopath and/ or homeopath remedies OTC (n=18)	2 (11.1)	2 (11.1)	2 (11.1)	6 (33.3)	4 (22.2)	2 (11.1)
Naturopath and/ or homeopath remedies prescribed by a practitioner (n=6)	0 (0)	1 (16.7)	0 (0)	1 (16.7)	4 (66.7)	0 (0)
Other commercial herbal products containing 2+ herbs (n=36)*	2 (5.6)	6 (16.7)	6 (16.7)	11 (30.6)	7 (19.4)	4 (11.1)
Rongoā (n=0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Other (n=70)*	3 (4.3)	1 (1.4)	5 (7.1)	6 (8.6)	30 (42.9)	25 (35.7)

*n= values differ from Table 3.4 due to non-responders to this question

3.4 Discussion

The current study aimed to gain an understanding of galactagogue use in BF women in Aotearoa. The survey indicated that galactagogue use was widespread (63.8%), and 82.5% of users reported consuming more than one galactagogue during BF. The results supported the hypothesis that use was related to PIM. Multivariate analysis found that use was more common in women who reported questioning their milk quantity, and PIM quantity was the only predictor for use. Surprisingly, this study also found that many women who did not report concern about milk quantity or concern about milk quality also used galactagogues.

3.4.1 Participants

Seven hundred and sixty-three women were included in the analysis. The median age of mothers in this study was 32 years, slightly higher than that of women giving birth in Aotearoa (30.5 years) (Stats NZ–Tatauranga Aotearoa, 2018b). 43.4% of women in our sample were aged 30–34 years, which was higher than the 35.2% of women giving birth in this age range as per 2024 Health NZ data (Health New Zealand Te Whatu Ora, 2024). The most recent available national data from 2018 shows that 14.5% of women have a bachelor degree of higher (Stats NZ–Tatauranga Aotearoa, 2018a). Comparatively, our study found the education level of mothers was higher, with 65.6% of participants reporting to have gained a bachelor's degree or higher qualification. The ethnic make-up of participants in this study was predominantly women who identified at least in part as New Zealand European (81.7%), compared to the overall population (67.8%) (Stats NZ–Tatauranga Aotearoa, 2023). Specifically, only 44.6% of mothers giving birth in Aotearoa in 2022 identified as European/other (Health New Zealand Te Whatu Ora, 2024). The caesarean section rate in our study matched the national caesarean section rate in 2022 (31.5%) (Health New Zealand Te Whatu Ora, 2024). Parity rates for this sample showed that 55.4% of participants were primiparous, higher than the 2022 national average (42.5%) of women giving birth. Comparatively, preterm birth rates in this sample were reported as 3.4%, slightly lower

than the 2022 national average of 7.8% (Health New Zealand Te Whatu Ora, 2024). The majority (47.3%) of participants reported a gross annual household income of >$120,000, which is comparable to the average yearly gross household income for the whole Aotearoa population as per the 2023 census ($126,411) (Stats NZ-Tatauranga Aotearoa, 2024). However, it is important to note that in 2022 48.5% of mothers who gave birth in Aotearoa specifically were classified as quintile four or five on the deprivation scale (Health New Zealand Te Whatu Ora, 2024) (NZDep 4/5 represent 40% of the country living in the second most and most deprived areas of NZ) (Atkinson, 2019), and the 2023 census reported that families in households in these classifications earned between $21,527 and $36,563 annually (Stats NZ-Tatauranga Aotearoa, 2024). This understanding is important to note as although the majority of our sample may be earning similar amounts to the general population when compared to females giving birth, our sample is likely to be higher earners. Overall, it is likely that our sample population is also older, more educated, and more likely to be European than BF mothers nationally. Thus, this sample may be more likely to use galactagogues than the general population, given previous literature has proposed a link between supplement use and demographic characteristics (Foote et al., 2003). Galactagogues could be considered a 'supplement'. NHANES 2011–2014 reported that supplement use in the United States was significantly higher among those with a household income >350% above the poverty level (Cowan et al., 2018). Similarly, observations were found relating to higher levels of education and behaviours such as dietary supplement knowledge and use (Alfawaz et al., 2017; Elsahoryi et al., 2023; Kofoed et al., 2015). This is likely due to the subsequent increase in health literacy that often comes with higher education levels or socioeconomic status. In combination, this may provide individuals with the means to purchase BF-related supplements or aids. The prevalence of use seen in our sample may be further exaggerated given there is literature suggesting mothers with lower socioeconomic status are less likely to be determined to/ desire to breastfeed and practice BF (Abegunde et al., 2021; Ajami et al., 2018; Foster et al., 2023; Senghore et al., 2018). Therefore, galactagogue use may be lower in the true population of all BF women in Aotearoa, given the high prevalence of tertiary education and higher-income earners in this sample.

Overall, it is important to note the differences between our sample and the larger population of BF women in Aotearoa, as it is a limitation to the generalisability of the results.

3.4.2 Use of Galactagogues

This prevalence of 63.8% of women using galactagogue is comparable to several other studies conducted in Western countries with convenience samples. Ryan et al. (2023) found 57.5% of American (n=1,294) mothers in their sample reported the use of any galactagogues, and McBride et al. (2021) found 60% of their Australian sample cohort (n=1,876) reported using one or more galactagogues F. Comparatively, there is a lower proportion of galactagogue users than reported in non-Western countries. Galactagogue use was as high as 76% in Malaysia (Tan et al., 2022) and 91.7% in Iran (Molavi Vardanjani et al., 2022). Differences may arise given the importance and prevalence of holistic health and traditional medicine in these areas. Similar to previous research, this study confirms that galactagogue use is widespread within the BF population.

In the current study, 82% of users used more than one galactagogue, compared to 46% in McBride et al. (2021). The maximum number of galactagogues used in our study was 13 compared to 10 in McBride et al. (2021). This may be due to the increased number of galactagogue options listed in the survey, capturing more multiple users. Similar to our study, Ryan et al. (2023) found oats were the most frequently reported galactagogue by women in the United States. However, Jia. (2023), the only other survey looking at galactagogue use by BF women in NZ, only found 10% of users reported using oats. This is a considerable difference compared to the 71.7% of galactagogue users who reported use in this current study. This finding is important to note as it may speak to the potential of reporting general consumption of oats in participants diets, rather than specifically for BF, despite this being clearly stated in the survey question. The other commonly used galactagogues reported in our study were lactation cookies (n=289, 59.3%), nuts and seeds (n=205, 42.1%), breastfeeding/lactation tea (n=157, 32.2%), and yeast products (n=156, 32.0%). Lactation cookies were the most commonly reported galactagogue in an Australian study (McBride et al., 2021). Breastfeeding/lactation tea was

not provided as a galactagogue option in McBride et al. (2021), and only 23% reported use in the US. The lack of and low prevalence of use in these studies is a surprising finding, given that breastfeeding/ lactation tea has been used by women for decades, and is rooted in traditional use (Lawrence & Lawrence, 2016). It may be that the commercialisation of galactagogues in general through social media over the past few years has seen a rise in tea as an option for women (Zizzo et al., 2021). Eight per cent of our participants reported using a combination of herbal products, reflecting the findings in McBride et al. (2021) (6%). However, this is dissimilar to Ryan et al. (2023) who reported that a considerable number of their sample used them (23%). Disparities may be seen due to the differences in pharmaceutical regulations between the United States and Australia/ New Zealand ("New Zealand Food Act 2014," 2014). Therapeutic Goods Administration/ New Zealand Food Act regulates herbal supplements more rigorously, and thus accessibility and availability may be a potential explanation for these findings. These differences could also be attributed to the cultural differences between populations in the United States and Aotearoa.

Despite being a relatively small proportion of the participants, of those who took “other commercial products” or specified “other” foods, lactation blends came up consistently from participants in this study. ‘Mammas milk bar’, ‘Milk Collective’, and ‘Two Islands’ were three brands of these blends named consistently by participants. These brands promote and sell variations of lactation hot chocolate-like food items marketed as lactation aids. These lactation-specific blends are new commercial products becoming more heavily marketed and publicised in the Aotearoa market in-store and online. These findings align with previous qualitative research by Zizzo et al. (2021) suggesting that women are influenced by the marketing of these goods, which may be leading to prevalent use in this population despite lack of current evidence of efficacy (Bazzano et al., 2016a; Kwan & Abdul-Rahman, 2021; Zizzo et al., 2021).

3.4.3 Aspects of Galactagogue Use

Reasons for galactagogue use

The findings of our study revealed that 'increasing milk supply' was the most reported reason for using galactagogues (50.8%). Molavi Vardanjani et al. (2022) found that 66.4% of Traditional, Complementary, and Integrative Medicine (TCIM) use, which encompassed galactagogues, was to induce or promote lactation, and 67.7% of users in Ali et al. (2020) stated enhancing breast milk production was the main reason for use. Although the trends are the same, our study found smaller proportions of women using galactagogues for these reasons compared to Ali et al. (2020) and Molavi Vardanjani et al. (2022). This may be attributed to the cultural differences between these two studies and ours, given the difference between BF ideologies in 'Western' versus 'non-Western populations. These studies consistently show that use is most commonly related to increasing breast milk production. This may suggest that women believe a greater supply is necessary for BF or is becoming the new normal when it comes to the behaviours around BF.

Surprisingly, we found that a large portion of women who reported no concerns with their breast milk quantity and quality still used galactagogues. Similarly, Ali et al. (2020) found only slightly more than a quarter of their sample reported inadequate milk production, yet the large majority used galactagogues. This suggests that some women may be using galactagogues pre-emptively to ensure their breast milk production is adequate, or again, the idea that when it comes to breast milk, 'more is better'.

Commencement of galactagogue use

Our study found that women most commonly began using galactagogues within the first week postpartum. This early initiation was nearly twice as likely in our study compared to Australian women (McBride et al., 2021). Sim et al. (2014) reported on the use of herbal galactagogues by 20 women through a qualitative lens. Their findings indicated that initiation of use ranged from three days to seven months postpartum. It is difficult to compare results between populations due to the unknown demographic details in other studies.

Lactation cookies are commonly advertised as a baby shower gift on mum and baby-focused websites and groups (Global Baby, 2024). Given that only 10% of BF women in this study continued to use

lactation cookies throughout BF, it may be the case that women had been provided with these goods as gifts and thus consumed them early on and then discontinued use after they were finished.

McBride et al. (2023) also looked at the commencement of use, specifically in domperidone. They found that 20% of users began within the first seven days, far higher than the 5.9% of women in our study who commenced domperidone use in the first week. We found the greatest majority (43.1%) started domperidone between two and four weeks postpartum, which is unsurprising given the mechanisms of milk production, the effects of domperidone, and the fact that this is not a first-line treatment (Bellhouse, 2019). Twelve per cent of women reported starting using a galactagogue two or more months postpartum. Although we cannot differentiate, this is a significant number of women who either use their first galactagogue or try a new iteration of galactagogue that they have not yet turned to, at later stage of BF. This highlights the need for BF support, both pre and post-natal, to ensure EBF till six months of age, as women are still searching for food items to aid BF at this point .

The data suggests many women may be taking galactagogues as a 'prophylactic' substance in the absence of any perceived or actual problem. Whether that is because they were given them as presents or because they believe they will help with BF early on. It is crucial BF management messages are well communicated, especially in the first few weeks postpartum, given the commencement of galactagogues early on. Then, if women choose to use galactagogues for BF, this should be in addition to management strategies. Using galactagogues prophylactically or to aid with BF issues may be becoming the new normal in NZ and this study's results may be an indication of the changing environment. Potential concerns arise if galactagogues are used instead of evidence-based recommendations to increase milk production, e.g., feeding frequency (Amir, 2006; Lawrence & Lawrence, 2016). The results from this study can help ensure that HCPs are aware of galactagogue use and are questioning and providing this population with education on the guidelines when they face PIM.

It is important to note that nuts and seeds, and oats make up a large proportion of the types of galactagogues being used before the baby was born. This is an interesting finding that may highlight a

study limitation. This study asked women to indicate if they had consumed any foods with the intent of 'supporting BF or influencing milk supply' but given these are the foods most used and are everyday pantry/ dietary items, it may be the case that women reported the use of these galactagogues as incidental rather than intentional. We cannot know if this was the case, but it should be considered, given the findings.

Duration of galactagogue use

Taking a galactagogue for a short period, less than one week and even less than one month, was relatively uncommon for women in this sample. Only one other study has looked at the duration of use and conducted this with a qualitative lens. Sim et al. (2014) reported that the duration of use ranged from one week to nine months. Our study quantitatively repeated these findings and found use lasted even longer. This study found use ranged from less than one week to up to 12–23 months. It is important to note that our study asked women to report on the duration of use for specific galactagogues from birth until they took the survey. This period could vary considerably depending on the age of the child and has implications specifically for women who answered using galactagogues for "the entirety of BF" or "on and off during BF". The entirety could mean one week for one woman with a newborn, or 23 months plus for women with a much older baby. The galactagogues most commonly consumed from birth to the time of taking the survey were oats, and nuts and seeds, whereas lactation cookies were more likely to be used for less than one month.

Galactagogues such as oats and nuts and seeds are likely cheaper options more readily available to participants, which is also an important point to consider. For example, lactation cookies range from $10–15 for 12 cookies, as opposed to a 750g bag of oats and 500g of linseeds with a total cost of ~$7.00 and yielding far more (Mums & Bubs NZ, 2024; Woolworths, 2024). This considerable price difference may account for the differences in patterns of use of galactagogue types (Zizzo et al., 2021). It may also be that women initially use these items as galactagogues, then continue to use them out of dietary habit.

McBride et al. (2023), looking at the use of domperidone, found use ranged from one week to more than one year, with the median being 6 weeks. Steyn et al. (2017) only reported on the use of sulpiride and found the median duration of use was similar to that of domperidone in the Australian cohort, at 4 weeks. In our study, of those who took pharmaceutical galactagogues (domperidone), women mostly took this substance for the eternity of BF, potentially higher than both former studies. However, it is difficult to quantify as we cannot determine the duration of 'the entirety of BF'. Extended duration of consumption is cause for concern; there are limited efficacy data on domperidone use, no long-term (>4 weeks) clinical trials were conducted (Knoppert et al., 2013; Osadchy et al., 2012; Wan et al., 2008), and when used for gastrointestinal-related issues, domperidone used for extended periods has been linked to cardiac arrhythmias (Günlemez et al., 2010; Johannes et al., 2010; Leelakanok et al., 2016; van Noord et al., 2010). In NZ, the use of domperidone to increase milk supply in BF is prescription only. HCP's, are recommended to use the lowest effective dose for the shortest possible time for these reasons, and women should be closely monitored for side effects (MEDSAFE-New Zealand Medicines and Medical Devices Safety Authority, 2023).

3.4.4 Factors Associated with Galactagogue Use

The results discussed in this section of the thesis concern the bivariate analysis conducted between galactagogue use and maternal characteristics.

This study found no significant association between maternal age and galactagogue use. However, Ryan et al. (2023) and Grzeskowiak et al. (2015) found mothers of older age more commonly reported galactagogue use. Jia. (2023) also found that increased maternal age was associated with galactagogue use in an Aotearoa population. Comparatively, McBride et al. (2021) found mothers of a younger age were more likely to be galactagogue users. The lack of significance in this study aligns with a plethora of studies that have also found no association (Foong et al., 2020; McBride et al., 2023; Millinga et al., 2022; Molavi Vardanjani et al., 2022; Shen et al., 2021; Sim et al., 2013). These

inconsistencies may be due to the cultural differences across the populations and the limitations of using convenience samples in observational studies.

Our study significantly associated parity (primiparous vs multiparous) with galactagogue use, with first-time mothers being more likely to be users. This link could be attributed to the associations that have previously been found between parity and BF self-efficacy (Bartle & Harvey, 2017; Çimen et al., 2024; Ngo et al., 2019). Research indicates that first-time mothers feel less confident in their ability to BF and may turn to alternative solutions (Huang et al., 2022; Ryan et al., 2023). Of important note, Jia. (2023) found no association between parity and galactagogue use in BF women in Aotearoa. However, this may be attributed to the significantly smaller sample size (n=72) and the inability to make any conclusions.

Having a caesarean section was positively associated with galactagogue use. This birth characteristic has consistently been reported in the literature as associated with use (Grzeskowiak et al., 2015; McBride et al., 2023; McBride et al., 2021; Ryan et al., 2023). Caesarean section is also a common risk factor associated with BF difficulties, which may be why we see this finding. Having a caesarean section birth was linked with delayed onset of lactation, delayed BF initiation, reduced EBF rates, and self-reported insufficient milk supply (Li et al., 2021; Li et al., 2024; Segura-Pérez et al., 2022). All these factors may make BF more stressful or difficult and may drive women to use galactagogues prophylactically or to aid their issues (Zizzo et al., 2021).

Premature infant birth (before 37 weeks) was not associated with using galactagogues in this study. Current literature has inconsistent findings on the link between this birth characteristic and galactagogue use. Two Australian studies conducted over the past nine years were consistent in their conclusions that premature birth is linked with use (McBride et al., 2023; McBride et al., 2021). Yet, no associations were found in the United States population studied in Ryan et al. (2023) among many other populations where no significant associations were found (Foong et al., 2020; Molavi Vardanjani et al., 2022; Shen et al., 2023). These inconsistencies across the literature speak to the need for more research comparing maternal characteristics of users against non-users.

Our study found a significant association between previous galactagogue use and using galactagogues again. This finding is noteworthy, given the association between parity and use, and it could be considered contradictory. However, Zizzo et al. (2021) conducted a qualitative study investigating the factors influencing galactagogue use with Australian women. This indicated that women who had used galactagogues before were more likely to use them again. It also found that mothers had used other strategies to increase milk production before moving to this option, indicating the importance and benefits of evidence-based strategies (Amir, 2006; Lawrence & Lawrence, 2016). McBride et al. (2023) asked galactagogue users to indicate if they would recommend galactagogue use to a friend, of which 82% reported they would. We could conclude that these women are potentially satisfied with their experience with galactagogues and their perceived positive effects and lack of adverse outcomes. Research into previous use needs further investigation to understand how the environment in other populations currently stands and how this compares to our findings.

3.4.5 Perceived Insufficient Milk and Galactagogue Use

Perceived Insufficient Milk quality and quantity prevalence

This study found that more than half of the respondents in this study often reported PIM quantity. Reporting PIM quality was much less common in this sample. The prevalence of PIM in BF women across the world is not well understood and varies significantly depending on the population. Our prevalence is much higher than Huang et al. (2022), who concluded that the incidence of PIM in BF mothers ranged from 10 to 25%. Our results align more closely with those of McBride et al. (2021) who found that PIM was reported by 49% of mothers. Among domperidone users alone, PIM was present in 92% of participants in McBride et al. (2023); however, this is logical, given domperidone is a prescription-only medication indicated for use in mothers with low milk production. Additionally, our finding was much higher than the 14.9% PIM reported in the United States population by Ryan et al. (2023). The higher prevalence in our study may be due to the differences in recruitment processes

between the two. Our survey was distributed to several BF-specific Facebook groups where content posted to these groups was predominantly women reaching out for help and support with BF issues. This may mean that we were recruiting from a group that was more likely to be experiencing problems, and therefore this may be why we see a higher prevalence. Importantly, our finding is much higher than the prevalence found by Jia. (2023) in the same target population in Aotearoa. Eighteen per cent of women reported experiencing PIM in Jia. (2023), and our study found the prevalence to be more than two times this, despite both recruiting BF women in Aotearoa. Recruitment for the two studies differed, which may be why we see these differences. Responses for Jia. (2023) came from a baseline survey of participants who were part of an RCT looking at the effect of a yeast-based supplement on breast milk composition. It may be that women with real problems may not sign up for an RCT, or the small sample size (n=22) may have skewed the results. Nonetheless, these differences further indicate the need for more research in Aotearoa to understand PIM's prevalence better, given its strong link with early cessation of EBF in women (Huang et al., 2022).

Association between PIM and galactagogue use

This study asked women to report their perceptions of milk quantity and milk quality, and we found associations between both aspects and the use of galactagogues. This reporting indicates that women were worried about both milk quantity and quality. However, analysis found PIM quantity was the only predictor of galactagogue use. PIM is most commonly defined as a state in which a mother has or perceives to have inadequate or insufficient breast milk production to meet her infant's needs (Hill et al., 1997). previous qualitative research found BF women in NZ using galactagogues were concerned with both quality and quantity of their breast milk (Jia, 2023), thus we asked about both quality and quantity in our study. This finding is consistent with several large population-based samples indicating that there is an association between the use of galactagogues and experiencing PIM (McBride et al., 2023; McBride et al., 2021; Millinga et al., 2022; Ryan et al., 2023; Steyn et al., 2017). These findings are also consistent with qualitative research conducted by Zizzo et al. (2021), indicating a concern for breast milk - true or perceived- was the trigger for women to begin investigating or deciding to use

galactagogues. This association is important as it indicates that a significant number of women are worried about their breast milk production, and this perception is leading to a behaviour that has a lack of evidence of efficacy (Bazzano et al., 2016a; Kwan & Abdul-Rahman, 2021). We should consider what other behaviours mothers may do when they experience PIM. There is a large body of research that indicates that perceived low breast milk is a contributing factor leading to the use of infant formula and may contribute to the relationship between PIM and the early cessation of EBF (Barnes et al., 2021; Kera et al., 2023; Paramashanti et al., 2023). It is important to keep in mind that with PIM; perceived insufficient milk supply, milk quality and quantity may be sufficient or improved with BF management. However, if the perception leads to supplementing with formula, this can lead to decreased milk production and potentially the cessation of BF. Thus, the use of galactagogues and their association with PIM are important findings to consider and investigate further. We need to better understand what else is being done by mothers in conjunction with using galactagogues, at what stage of questioning milk production does mothers turn to galactagogues, and how can we better support women from turning a perception into behaviours if galactagogues are being used in solidarity without other BF management strategies.

It is important to note that in the current study, a considerable number of women who did not report PIM milk quantity or quality still used galactagogues. Fifty-four per cent of women who never reported PIM quantity proceeded to consume galactagogues, and 44% of those women who never reported PIM quality also reported use. This is an interesting result to consider. Women are using galactagogues, which are, by definition, 'substances that can increase or maintain breast milk production' (Foong et al., 2020), yet they do not report quantity or quality to be a problem. Our study (p<0.001) and research indicate that using galactagogues with previous children is associated with an increased likelihood of using galactagogues again (McBride et al., 2023; Zizzo et al., 2021). Women may use galactagogues because they had previously, or prophylactically, with the idea that issues may arise or 'more is better' as explained above. This pre-emptive use may be why we see this finding. However, the percentage of

women is large, and there are likely many reasons why women use galactagogues despite no perceived problem with milk supply.

This finding also brings up a meaningful discussion point in understanding if using galactagogues is a barrier to BF. The barrier is that women feel they need to use these substances to breastfeed successfully, and as in some cases they are an extra expense or are marketed in this way, they act as an economic barrier for many women. The results show that a significant number of women are consuming galactagogues in the absence of a perceived problem. It could be hypothesised that women believe that they are 'needed' to be taken to breastfeed successfully. This may be why we also see these substances being consumed so early in the postpartum period or during pregnancy. Nearly half the participants had taken at least one galactagogue before birth or within the first week postpartum. Given the biological mechanisms of BF, it would be before we see any true milk production issues (Eglash et al., 2008). This further speaks to the potential that women view galactagogue use as part of BF without experiencing PIM. A recent qualitative study recorded five UK mothers' real-time BF experiences using video diaries and found these women were exposed to increasing commercialisation. The impact of this marketing led the women to believe commercial solutions were essential aspects of their BF experience, and they became dependent on them (Taylor et al., 2020). It is important to note that galactagogues were not investigated. However, Zizzo et al. (2021) also commented on the prevalence of the commercialisation of these products on mothers' decisions to use. This notion indicates a potential societal shift concerning BF. The extent of this and how it impacts BF outcomes moving forward is unclear, but this possible change in BF culture needs further investigation.

Understanding why women who do not perceive their milk supply to be insufficient choose to or continue to use foods to support BF/ their milk production is an area that needs to be further researched. This is especially relevant given the potential side effects that are associated with and were reported by galactagogues users in other studies (Bazzano et al., 2016a; McBride et al., 2023;

Molavi Vardanjani et al., 2022; Sim et al., 2014; Steyn et al., 2017) and the potential additional expense that comes with some galactagogues.

3.4.6 Strengths, Limitations and Recommendations

The large sample size of this study was one of the main strengths. It allowed the findings to provide insight into a range of mothers' experiences with galactagogue use or non-use during their time BF. The nature of the online survey was also a strength of this study. This allowed for ease of access and a low-respondent burden to collect data from a wide range of women, especially in a population who tend to be time-poor and under high levels of stress. The online recruitment process promoted this study as a general BF study; not detailing galactagogue use was advantageous in capturing both users and non-users. This study's questions required participants to report on reasons for, commencement, and duration of use for all galactagogues they used. These details were a great benefit to this study's findings. Thus, adding to current research that looks at galactagogue use more generally. Additionally, the survey's wording of "Did you eat or drink anything to support BF or influence your milk supply or milk quality?" allowed women to interpret galactagogues in a way that was meaningful to them.

Although the survey was detailed in its quantitative questioning, the lack of qualitative data limited this study's design. This has implications for fully understanding the reasons behind when galactagogue use commenced, their duration, and the reasons behind the use. It was difficult to know why a large number of women who did not report PIM used galactagogues, and further research is needed to more clearly understand the expectations women have when using galactagogues to support BF. Another limitation of this study was the demographics of the sample group, making it less comparable to the broader Aotearoa population. Having women able to participate in this study independent of their stage of BF is a strength in understanding use across all periods of BF. However, this was also a limitation of this study. Using a galactagogue for the 'entirety of BF' was dependent on the age of the infant, and a woman may have still been BF; therefore, use may continue. This meant duration was unquantifiable as we do not know how long that BF period is or would be. Furthermore,

we could not know if galactagogues were used concurrently or added to the diet sequentially, and clarification on both points would be useful in future research. Lastly, in those women who experienced PIM, we are unable to associate the initiation of galactagogue use with when they questioned their production as we looked at this retrospectively.

These limitations lend themselves to future research to ensure we better understand the use of galactagogues by BF women in Aotearoa. It would be useful to have a more representative sample, emphasising diversity concerning use in the Māori and Pacific Island populations. It would also be essential to complete further research and ensure to include participants representing a wider range of education and income levels given the potential economic impact of specific galactagogues that are widely used. This research identified gaps in understanding the links between why women use galactagogues despite not experiencing PIM, when women begin using galactagogues specifically in relation to PIM, and if using more than one is a sequential or summative addition to their diet. Further understanding how galactagogues are used by all women in this population could help to provide indicators and key practical education points that HCPs need to look out for to ensure BF women are given adequate information to reduce the effect PIM has on BF.

3.4.7 Conclusion

In this study, the prevalence of galactagogue use was common among BF women, and women were more likely to use more than one galactagogue. The most reported galactagogues were oats, lactation cookies, and nuts and seeds. Increasing milk supply was the most cited reason for use, and use was most commonly commenced within the first week postpartum. PIM quantity was the only significant predictor for galactagogue use. Yet a large proportion of women who never experienced issues with milk quantity or quality proceeded to use galactagogues regardless of any BF issues.

Chapter Four: Conclusion and Recommendations

4.1 Research Outcomes

This study aimed to understand the scope of galactagogue use, reasons, timing and duration of use, and its association with maternal characteristics and PIM among BF women in Aotearoa. This study achieved all the objectives that were set. It was hypothesised that galactagogue use would be prevalent in this population. Our study found that a significant portion of the sample population used galactagogues in a range of products across their BF experience, consistent with previous research conducted in populations across the globe. It was also hypothesised that galactagogue use would be associated with older maternal age, primiparity, and those who had caesarean section. Previous research indicated women with these characteristics are more likely to use galactagogues. These associations were also found in this study in bivariate analysis. However, these associations were no longer significant when multivariate analysis was conducted. This study also found an association between previous and current galactagogue use, a finding that had not previously been found in the research. However, again, this association was only present in bivariate analysis. It is important to consider that although these associations were lost when multivariate analysis was conducted, the associations found in previous research were also based on bivariate analysis. Grzeskowiak et al. (2015) conducted a multivariate analysis and, associations between galactagogue use and maternal age, increased maternal BMI, primiparity, caesarean section delivery, preterm birth, and neonatal hospitalisation remained. Still, all other associations found in studies are based on bivariate analysis. In this way, our results align with the current research, but the differences between the analyses in our study are important to highlight. The final hypothesis for this study was that experiencing PIM would be related to initiating the use of galactagogues. After conducting multivariate analysis, it was determined that PIM quantity was the sole predictor of galactagogue use. However, no significant association was observed between PIM quality and galactagogue use. Of further interest, this study also found that galactagogue use was also relatively common among women who did not report either PIM quality or quantity and was not a finding we expected.

The significant outcomes of this study align with the current evidence. This study is the first evidence of widespread use of a range of galactagogues by BF women in New Zealand. This study was also the first to address both PIM quantity and quality and their association with galactagogue use and investigate the reasons, commencement, and duration of use for specific galactagogues in detail. This study's large sample size gives us increased statistical power regarding our results; however, it is essential to consider the limited representation in our population group and the difficulty that arises in relating it truly back to the Aotearoa population. Nonetheless, the findings provide insight into the current environment in Aotearoa and the implications that need to be considered, given galactagogues' prevalent use.

4.2 Research Impacts

There is only one prior study on the use of galactagogues in BF women in Aotearoa, and there is limited data on usage in populations worldwide. Therefore, our research provides new insight into the environment of galactagogue use specific to our population. This might influence further investigations on how galactagogues are researched and how we understand the current climate of BF more generally.

Additionally, and more significant to the health and well-being of BF women in Aotearoa, these findings should prove helpful to HCPs working with this population. Given the prevalence of use, the types, and the ways galactagogues are used in this study, HCPs should use this information to understand the behaviours in this population. Although 63.8% of women used galactagogues, more than a quarter did not. For HCPs, this signals the importance of recognising differences in the population, and there may be varying levels of knowledge, attitudes, and reasons behind use or non-use. Therefore, the importance lies in asking the question of whether women know or use these substances so they can provide the most applicable care. Due diligence should be enacted in giving adequate information to ensure BF women know what they are using, why they are using them, and the potential implications. Knowing whether a woman uses galactagogues is essential for HCPs as it

may provide insight into how BF is going for them more generally. The results showed that galactagogues were most commonly used to increase milk supply and were significantly associated with PIM quantity. If women use galactagogues, the support offered and provided by HCPs may differ from those not using galactagogues. Furthermore, these findings should indicate the need for HCPs to ensure women are aware of the evidenced-based strategies that aid in BF when issues arise, given the lack of galactagogue efficacy evidence. It is essential that women turn to these techniques instead of, or alongside, the initiation of galactagogue use so the best chance at EBF can be achieved.

This study also found that many women who did not report PIM quantity or quality still used galactagogues. It is important to consider this, as it may indicate changes occurring within the culture of BF in women. This finding, in combination with previous research indicating the potential impact of marketing and commercialisation of BF aids, may suggest that women may view galactagogues as products necessary for successful BF outcomes. This is impactful given the price that often coincides with these products and the extra pressure women may feel to try including these into the diet, which may act as a barrier. It is important to understand further that if galactagogue use is acting as a barrier, it may be impacting the number of women EBF until six months and continued BF beyond this point, which has many maternal and infant impacts.

4.3 Strengths

This survey is the first to examine in detail the use of galactagogues in BF women in Aotearoa. No study has previously investigated the types of galactagogues used in this population including the timing, duration, and reasons for use and explored sociodemographic and birth characteristics. This study's main strength is the moderately large sample of BF women. This sample was diverse and thus allows results that demonstrate a range of experiences; however, it is important to note that the sample was not truly representative of the population in Aotearoa. Therefore, the strengths lie in providing contextual insights into galactagogue use, the identification of widespread use, and patterns related

to reasons, duration, and timing of use. We can be confident in our results in this population, but we are limited to generalising this to the wider population.

The nature of this study's design also allowed for the greatest opportunity for a range of women to participate in this study with minimal burden or barriers. The online format meant the survey could be shared and spread nationwide. The layout allowed women to complete the survey as and when they had the chance, given the responsibilities and time pressures they face. The ease of access and low burden allowed for an in-depth understanding of the environment of galactagogue use and provided the ability to associate a range of maternal and infant characteristics with the use of these substances.

One key strength of this study is the thorough thought and detail that was spent articulating our survey questions. This survey asked women to indicate, *"Did you eat or drink anything with the purpose of supporting breastfeeding or influencing your milk supply or milk quality? For example, medications, supplements, herbs/herbal products, foods/drinks or Rongoā".* This exclusion of the word galactagogue was an intentional choice by the researchers. Remaining vague allowed women to interpret and include relevant foods rather than imposing a term such as 'galactagogue' that may be ambiguous or elicit biases on what they think they should be reporting. This study advertised itself as a "Breastfeeding in Aotearoa" study targeting all BF women. Excluding the word galactagogue to limit the potential skewing of results to recruit only users. Overall, this has meant that we have yielded responses that are more reflective of a broader range of experiences. By not using the term 'galactagogues' women are more likely to report what they are actually using rather than what they think they should be reporting on. We have created a more inclusive environment to capture a broader more authentic range of practices as women could report on foods that they think are important, and therefore improve the validity of our data.

The survey included questions on specific galactagogues individually, giving us more detail to understand the particulars regarding use. Previous studies in this area looked at use more generally, asking women to report on their use of a range of galactagogues. Our study asked women to provide

details on duration, commencement, and reasons for the use of each galactagogue that they used. This was beneficial in identifying differences in why specific galactagogues are used. For example, nuts and seeds were more commonly to support BF, whereas yeast products were more commonly used to increase milk supply.

4.4 Limitations

The most notable limitation of the study is the lack of representation of the population of BF women in Aotearoa. Thus, the results should be viewed with caution. The most marked difference in our sample compared to the wider Aotearoa population is the skew in ethnicity and sociodemographic characteristics of the respondents. Over 80% of our sample identified as New Zealand European, and all other ethnicities had less than half their representation compared to the population (Stats NZ Tatauranga Aotearoa, 2024). Of note, we had no respondent identify their use of Rongoā. Anecdotally, there are reports of Rongoā, such as papapa plant leaves used for milk supply (Tirohanga Ngahere-Canopy, 2024); however, we cannot speak to this as we had no report of any kind of Rongoā. Therefore, we cannot understand what these may include, to what extent these are being used in the community, and why. Given the large percentage Māori represent in Aotearoa and the potential significance that may be placed on Rongoa for healing for individuals in this community, understanding use is key in ensuring we have the complete picture (Mark, 2017). The lack of representation was also a particular issue concerning education and economic characteristics. Seventy-eight per cent of the women had a tertiary education, and 47% of women sat within the highest income bracket. Research indicates that the health-related behaviours carried out by individuals with higher education or income levels differ from those with lower (Jehn, 2022; Tran et al., 2021). This could bias the results as these women may be inherently more likely to make dietary and supplement-related changes during BF, including using galactagogues (Cowan et al., 2018; Foote et al., 2003).

A limitation of this study's design was the lack of qualitative data collected. Due to the study wanting to, and executing, the recruitment of a large number of responses, there were limited qualitative

questions. This omission meant we could not further probe to understand the why behind the results we collated. For example, why did a large majority of mothers who did not report PIM use galactagogues? These qualitative questions have not been analysed yet and have not addressed many follow-up questions left unanswered. It is important to note that this limitation is linked to the nature of the study design, which as explained above, was a strength of the study.

This study's inclusion criteria meant that women currently BF and those who BF in the past year could participate. This helped elicit a large sample size. However, it proved limiting when looking at the duration of galactagogue use. Women were asked how long they used each galactagogue; however, as women were all at different stages of their BF journey, this affected the complexity of the 'duration of use' data, specifically for those who used galactagogues for the "entirety of BF" or "on and off during BF".. For a woman one month postpartum, the entirety could be only one month, compared to a woman with an 18-month-old who may have EBF till six months and remains BF. Quantifying the duration of use is difficult and a limitation of the data.

Finally, the survey asked women to report on their usage of galactagogue throughout their time BF, which for some women could be up to 23 months. This large time span leaves room for the potential of recall bias. Two years is a considerable length of time, and for some women, the types of galactagogues used over this time may have fluctuated and thus we may elicit inaccurate reporting. This is specifically true as we asked women to comment on all the galactagogues they used, and if many were used, the specifics may not be easily retrievable for women. This survey included only a multichoice question on the use of a range of galactagogues as the method to collect data on usage. There was no other question or methodology i.e., 24-hour recall, to corroborate the information provided to this single question. Thus, the effects of this cannot be known, and this is a study limitation. Results should be considered with this in mind.

4.5 Recommendations

Based on the findings of this study, some recommendations could be applied to further research in this field. These are outlined below:

- The current study's population-ethnic ratio does not reflect the composition of Aotearoa ethnicity. If the survey or a survey looking at a similar topic were to be completed again, it would be essential to develop specific ways to target BF women of different ethnicities. Specifically, the Māori and Pacific Island populations should be targeted to understand better how use may differ from the predominantly European sample our results represent. Given that the results provide a good overall understanding of galactagogue use in the NZ European population, conducting a survey that focuses explicitly on these groups may be beneficial. This could then be combined with the results found in this study to understand a more significant percentage of the population, as well as a deeper understanding in these specific groups.
- To conduct research that reflects all sociodemographic groups within Aotearoa, given that most women in our sample had tertiary education and lived in a household with a total annual income of more than $120,000. The behaviours and trends of women who do not identify with these characteristics may differ, given what we know about the potential economic burden of several galactagogues. Understanding the use of galactagogues in this group would be helpful; if galactagogues are seen as necessary to BF successfully and are a financial burden, then it may be the case that this is more of a barrier in other groups.
- Given the number of women who used galactagogues in absence of reporting PIM quantity or quality and the research that suggests the marketing for BF products influences women, it would be useful to undertake research into understanding where women are getting their information about galactagogues and their knowledge of these products. This would provide an understanding of what women know and, thus how and what kind of information HCPs may need to pass on to women or the myths they may need to debunk.

- To conduct research with a qualitative lens with BF women to understand the why behind our results more clearly. This may include why women who did not experience PIM used galactagogues, why women who did experience PIM did not use galactagogues, or why women turned to the use of galactagogues. It would also be important to understand how women use galactagogues in combination with other BF management strategies to increase supply and quality, backed by evidence.
- To conduct further research into how galactagogue use fits the overall BF picture, specifically concerning PIM. Develop a new survey that looks explicitly at women using galactagogues during their experience with PIM, including what point women turn to galactagogues, if they include many galactagogues at once or in a sequential pattern, what galactagogues they use first, and what other strategies women employ to aid with BF issues given the evidence behind other methods such as increasing feeding.

Despite the limitations, the results of this large-scale study provide a broad understanding of the current galactagogue use by BF women in Aotearoa. The results demonstrate the widespread use, a significant range of galactagogue types, and the association with perceived insufficient milk quantity. The current study and these recommendations do not consider the impact of galactagogues on this population but provide insight into their current use. Therefore, more research is required to assess the perceived effects of these substances on those who use them, their effectivity, side effects, and their positive or negative impact on BF.

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Appendices

Appendix A. Study advertisement

Breastfeeding in New Zealand Study

an online survey of breastfeeding experience, support and changes to food and drink while breastfeeding

Seeking breastfeeding people to take part in an ONLINE SURVEY to investigate:

- Your experience breastfeeding;
- What supported your breastfeeding;
- Changes to what you eat and drink during breastfeeding.

If you are breastfeeding or have breastfed in the past year, we would like to invite you to take part in. All participants will be in the draw for one of four $50 gift vouchers.

SCAN HERE FOR MORE INFO

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

This project has been reviewed and approved by the Massey University Human Ethics Ohu Matatika 1, Application OM1 23/54. If you have any concerns about the conduct of this research, please contact the Chairperson, Massey University Human Ethics Ohu Matatika 1, email humanethics1@massey.ac.nz.

Appendix B. Participant information sheet

MASSEY UNIVERSITY
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School of Food and Advanced Technology
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PO Box 11 222
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Breastfeeding in New Zealand: an online survey of breastfeeding experience, support and changes to food and drink while breastfeeding

INFORMATION SHEET

Researchers Introduction

Kia Ora! We, Dr Janet Weber and Dr Louise Brough, are researchers in the School of Food and Advanced Technology, Massey University, Palmerston North.

Project Description and Invitation

We would like to invite women who are breastfeeding now or have breastfed in the past year to take part in an online survey. This survey will help us to learn more about women's breastfeeding experiences, what they do to support breastfeeding, and changes of food and drink while breastfeeding.

Participant Identification and Recruitment

We aim to recruit at least 250 women for the survey. The study advertisement has been distributed online via Facebook, breastfeeding groups, and community groups as well as through childcare services. If you decide to take part in this study, you can access the survey using the link or QR code on page 2 of this information sheet. Before accessing the survey, you will be asked to give consent.

After completion of the survey, you can choose to be in the draw to win one of four gift cards (value $50 each). There is no risk to participants in this study.

Project Procedures

It will take 10- 20 minutes to complete this survey (depending on your answers you may be asked additional questions). You can take the survey via your desktop, laptop, tablet or cell phone, but some of the questions may be easier to read on desktop and laptop. You will be asked questions about how you fed your baby since birth, how you changed your diet when breastfeeding, what your milk supply was like, and how you responded to breastfeeding challenges. We will also ask question about your birth and labour and demographic information such as ethnicity, education level, income etc.

There is no conflict of financial interest in this study.

Data Management

The data will be analysed and written reports will be provided for postnatal health care providers and published in scientific journal(s). Results will be shared with interested participants- at the end of the survey you will be given the option to request a summary of results to be sent to you.

We will protect your privacy and all your information provided will be kept strictly confidential. Your name and contact details are required only if you choose to receive a summary of results or choose to be in the draw, and all the detailed personal information will be kept separately from the data. Your answers will be confidential, and your name will not appear in any reports.

All the data will be kept in password protected files on Massey Onedrive and only accessible by the research team. The data, without identifying personal information, will be stored in an open access database (OSF) so that other researchers can refer to it if they are researching a similar topic.

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Participant's Rights

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

- decline to answer any particular question;
- ask any questions about the study at any time during participation;
- be given access to a summary of the project findings when it is concluded.

Project Contacts

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

Dr. Janet Weber, Senior Lecturer
Telephone: 06 951 6562
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Dr. Louise Brough, Associate Professor
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Email: L.Brough@massey.ac.nz

Ethics approval

This project has been reviewed and approved by the Massey University Human Ethics Ohu Matatika 1, Application OM1 23/45. If you have any concerns about the conduct of this research, please contact the Chairperson, Massey University Human Ethics Ohu Matatika 1, email humanethics1@massey.ac.nz.

Appendix C. Massey University Human Ethics Committee Ohu Matatika 1, Application OM1 23/54

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

16/07/2024

Dear: Dr Janet Weber

Re: Ethics Application - OM1 23/54 - Use of galactagogues in Aotearoa New Zealand

Thank you for the above application that was considered by the Massey University Human Ethics Committee:

Ohu Matatika 1 at their meeting held on **Tuesday, 5 December 2023**

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

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

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

Yours sincerely

Professor Tracy Riley,
Acting Chair, Research Ethics Chair's Committee

Research Ethics Office, Research and Enterprise
Massey University, Private Bag 11 222, Palmerston North, 4442, New Zealand T 06 951 6841; 06 95106840
E humanethics@massey.ac.nz; animalethics@massey.ac.nz; gtc@massey.ac.nz

Appendix D. Survey

Consent

Welcome to "Breastfeeding in New Zealand: an online survey about breastfeeding practice, milk supply and changes to diet". This survey will explore women's breastfeeding experiences, changes of food and drink during breastfeeding, perception of milk supply, and what they do in response to their perception of milk supply.

To take part in this survey you should be currently breastfeeding OR have breastfed in the past year AND you should have lived in Aotearoa New Zealand for at least part of the time while breastfeeding your youngest child.

Please confirm the following before you start:

- I have read and understand the Participant Information Sheet.
- I have been given sufficient time to consider whether or not to participate in this study. I understand that taking part in this study is voluntary (my choice).
- I consent to the research staff collecting and processing my information, including information about my health.
- If I do not complete the survey my information will not be used.
- I understand that my participation in this study is confidential and that no material, which could identify me personally, will be used in any reports on this study.
- I know who to contact if I have any questions about the study in general.
- I will receive a summary of the results from the study if I choose the option to receive the summary.

By clicking the button below, you acknowledge that your participation in the study is voluntary, you are 16 years of age, and that you are aware that you may choose to stop participating in the study at any time and for any reason.

- ○ I consent, I want to participate
- ○ I do not consent, I do not wish to participate

Grouping questions

Thank you so much for giving your time to participate in this study. We will ask a bit about your youngest child, your previous breastfeeding experience, and a bit about yourself.

It will take 10-20 minutes to answer all the questions. Be assured that all answers you provide will be confidential. If you are not able to answer all the questions at once, please feel free to come back later. Your answers will be auto saved by the system for 24 hours if you ***open the survey in the same browser****.*

Please try to answer all questions. If you skip a question you will be given a 'warning' but if you don't want to answer you can go ahead to the next page.

First we would like to ask you some questions about feeding your baby (or your youngest child).

How old is your baby? (youngest child if you are breastfeeding more than one child)

- 0-5 months
- 6-11 months
- 12-23 months
- ≥24 months

What is the gender of your baby/youngest child?

- Male
- Female
- Intersex
- Prefer not to say

The questions in this survey refer to feeding THIS baby/child.

Are you currently breastfeeding? (including giving the baby expressed milk from you.)

- No
- Yes

How long ago did you stop breastfeeding your youngest child?

- less than one month ago
- 1-6 months ago
- > 6 months to 1 year ago

How long did you breastfeed your baby/youngest child?

Year

Month

Week

Feeding history >6 months

Which of the following has been given to your baby/youngest child BEFORE he/she was 6 months of age. (Mark **all** that apply to you.)

- [ ] Breast milk (including feeding on breasts and expressed colostrum/breast milk)
- [ ] Donor breast milk and/or colostrum (including wet nursing)
- [ ] Formula
- [ ] Solids
- [ ] Other foods/drinks (not including prescribed medicines)

Please indicate the reasons your baby/youngest child was given any drink/food other than your breast milk BEFORE your he/she was 6 months old. (Mark **all** that apply to you.)

- [ ] Breastfeeding problem (e.g. trouble sucking, nipple problem, feeding pain, etc.)
- [ ] Separation from my baby (e.g. baby in neonatal unit, sick baby, back to work, etc.)
- [ ] I needed to take medication that was not safe with breastfeeding
- [ ] My baby was not gaining enough weight
- [ ] My baby was ready for solids
- [ ] I didn't have enough milk
- [ ] My breast milk alone did not seem to satisfy my baby
- [ ] So I could feed the baby in public
- [ ] My partner and/or other family members wanted to feed the baby
- [ ] To help my baby sleep
- [ ] Breastfeeding was time consuming/ inconvenient/ unpleasant
- [ ] Pumping or expressing was too inconvenient, time consuming, stressful
- [ ] Other, please explain

Please RANK the top three (3) reasons your baby/child was given food/drink other than breastmilk before he/she was 6 months old. '1' means that the reason is most important, '2' means that the

reason is the second most important, and so on.

» Breastfeeding problem (e.g. trouble sucking, nipple problem, feeding pain, etc.)

» Separation from my baby (e.g. baby in neonatal unit, sick baby, back to work, etc.)

» I needed to take medication that was not safe with breastfeeding

» My baby was not gaining enough weight

» My baby was ready for solids

» I didn't have enough milk

» My breast milk along did not seem to satisfy my baby

» My baby was old enough and the difference between breast milk and formula was minimal

» My partner and/or other family members wanted to feed the baby

» To help my baby sleep

» Breastfeeding was time consuming/ inconvenient/ unpleasant

» Pumping or expressing was too inconvenient, time consuming, stressful

» Other, please explain

Please indicate all the types of feeds given to your baby/youngest child AFTER he/she was 6 months of age. (Mark **all** that apply to you.)

- [ ] Breast milk (including breastfeeding and expressed breast milk)
- [ ] Donor breast milk (including wet nursing)
- [ ] Formula
- [ ] Solids
- [ ] Other, please state what

How old was your baby when he/she was first fed formula?

Year

Month

Week

How old was your baby when he/she was first fed formula?

Month

Week

How old was your baby when he/she was first fed solids?

Year

Month

Week

How old was your baby when he/she was first fed solids?

Month

Week

Please indicate the reasons you stopped breastfeeding. (Mark **all** that apply to you.)

- [ ] Breastfeeding problems (e.g. trouble sucking, breastfeeding pain, biting/teething, etc.)
- [ ] Baby was unwell
- [ ] I needed to take medication and was told to stop breastfeeding
- [ ] Breast milk alone did not seem to satisfy my baby
- [ ] My baby was not gaining enough weight
- [ ] I didn't have enough milk
- [ ] I wanted/needed someone else to feed the baby
- [ ] Breastfeeding was time consuming
- [ ] I want my baby sleep through the night
- [ ] I had breast fed long enough/achieved my breastfeeding goal
- [ ] New pregnancy
- [ ] My baby lost interest/self weaned

- [ ] Pumping or expressing was too inconvenient/ time consuming/ stressful
- [ ] Other, please explain

Please RANK the top three (3) reasons you stopped breastfeeding. '1' means that the reason is **most important**, '2' means that the reason is the second most important, and so on.

» My baby had trouble sucking or latching on

» Separation from the baby (e.g. sick mother/baby, getting back to work, etc.)

» My baby was old enough that the difference between breast milk and formula was minimal

» Breast milk alone did not seem to satisfy my baby

» My baby was not gaining enough weight

» I didn't have enough milk

» I wanted/needed someone else to feed the baby

» Breastfeeding was time consuming

» I want my baby sleep through the night

» I had breast fed long enough/achieved my breastfeeding goal

» New pregnancy

» My baby lost interest/self weaned

» Pumping or expressing was too inconvenient/ time consuming/ stressful

» Other, please explain

Feeding history 0-5 months

Which of the following has been given to your baby since he/she was born. (Mark **all** that apply to you.)

- [ ] Breast milk (including feeding on breasts and expressed colostrum/breast milk)

- [ ] Donor breast milk and/or colostrum (including wet nursing)
- [ ] Formula
- [ ] Solids
- [ ] Other, please say what was given

How old was your baby when he/she was first fed formula?

Month

Week

How old was your baby when he/she was first fed solids?

Month

Week

Please indicate the reasons your baby has been given drink/food other than your breast milk. (Mark **all** that apply to you.)

- [ ] Breastfeeding problems (e.g. trouble sucking, breastfeeding pain, biting/teething, etc.)
- [ ] Separation from my baby (e.g. baby in neonatal, sick baby, back to work)
- [ ] I needed to take medication that was not safe with breastfeeding
- [ ] My baby was not gaining enough weight
- [ ] My baby was ready for solids
- [ ] I didn't have enough milk
- [ ] My breast milk alone did not seem to satisfy my baby
- [ ] So I could feed the baby in public
- [ ] My partner and/or other family members wanted to feed the baby
- [ ] To help my baby to sleep
- [ ] Breastfeeding was time consuming/ inconvenient /unpleasant
- [ ] Pumping or expressing was too inconvenient, time consuming, stressful
- [ ] Other, please explain

Please RANK the top three(3) reasons your baby was given food/drink other than your breastmilk. '1' means that the reason is most important, '2' means that the reason is the second most important, and so on.

» Breastfeeding problems (e.g. trouble sucking, breastfeeding pain, biting/teething, etc.)

07/10/2024, 16:34 Qualtrics Survey Software

Other, please explain

Please RANK the top three (3) reasons you stopped breastfeeding. '1' means that the reason is **most important**, '2' means that the reason is the second most important, and so on.

» My baby had trouble sucking or latching on

» Separation from the baby (e.g. sick mother/baby, getting back to work, etc.)

» My baby was old enough that the difference between breast milk and formula was minimal

» Breast milk alone did not seem to satisfy my baby

» My baby was not gaining enough weight

» I didn't have enough milk

» I wanted/needed someone else to feed the baby

» Breastfeeding was time consuming

» I want my baby sleep through the night

» I had breast fed long enough/achieved my breastfeeding goal

» New pregnancy

» My baby lost interest/self weaned

» Pumping or expressing was too inconvenient, time consuming, stressful

» Other, please explain

Milk supply

Did you ever question if your milk supply was enough?

- No, I made too much milk
- No, I had enough milk

- ○ Yes, once or twice I thought that my supply was not enough
- ○ Yes, there were periods of time when I worried my milk supply was not enough
- ○ Yes, I was always worried about my supply not being enough

Please indicate what happened that made you think your supply was too much.

What, if anything, did you do about having too much milk?

Thinking now about the quality of your breastmilk. Did you ever question if your milk quality was not good enough?

- ○ No, never
- ○ Once or twice
- ○ Sometimes
- ○ Often
- ○ Always

Please indicate what made think that you didn't have enough milk/ good enough quality. (Mark all that apply to you and/or select 'other' and explain.)

- ☐ My baby's behaviour was unsettled/crying a lot
- ☐ My baby didn't gain enough weight
- ☐ My baby didn't have enough wet and/or soiled nappies
- ☐ My baby fussed at the breast/ came off quickly
- ☐ My baby didn't wake a lot at night
- ☐ My milk looked watery
- ☐ My breasts were empty and/or soft
- ☐ I couldn't get enough milk from pumping/expressing
- ☐ I had to top up after a feed (with formula, expressed milk or donor breast milk)
- ☐ The health professionals I saw (midwife, lactation consultant, Well Child provider etc.) questioned my milk supply
- ☐ Other people questioned my milk supply (e.g. partner, family or friends)

- [ ] Other, please explain

What did you do in response to worrying about your milk supply and/or milk quality not being enough? (Mark all that apply to you.)

- [ ] Just carried on
- [ ] Expressed milk
- [ ] Added formula
- [ ] Block feeding (feed on one side for 2-3 hours or more)
- [ ] Talked to health professionals (midwife, lactation consultant, GP, herbalist etc.)
- [ ] Talked to family and/or friends
- [ ] Searched for information from books/magazines/Internet
- [ ] Took medication, herbs or special foods/drinks
- [ ] Other, please explain

Galactagogue use

Now we would like to know if you have made any changes to what you eat and drink while breastfeeding.

Since the birth of your baby/ youngest child, did you take any vitamin or mineral supplements?

- ○ No
- ○ Yes, but I'm not taking any longer
- ○ Yes

What vitamin/mineral supplements did you take? What was the reason you took them? AND how long did you take them for?

What vitamin/mineral supplements did you take/ are you taking now? What is the reason you did take/ are taking them?

Since the birth of your baby/ youngest child, did you eat or drink anything with the purpose of **supporting breastfeeding** or influencing your milk **supply** or milk **quality**? For example medications, supplements, herbs/herbal products, foods/drinks or Rongoā.

- ○ No
- ○ Yes

In relation to breastfeeding your youngest child, what did you take with the purpose of **supporting breastfeeding** or influencing your milk **supply** or milk **quality**? (Mark **all** that apply to you.)

- ☐ Breastfeeding tea/lactation tea
- ☐ Lactation cookies
- ☐ Complan
- ☐ Yeast product (brewer's yeast, nutritional yeast etc.)
- ☐ Fenugreek
- ☐ Blessed thistle
- ☐ Milk thistle
- ☐ Fennel
- ☐ Oats
- ☐ Nuts and seeds (e.g. almonds, flaxseeds etc.)
- ☐ Domperidone
- ☐ naturopath and/or homeopath remedies OTC (over the counter)
- ☐ Naturopath or homeopath remedies prescribed by practitioner
- ☐ Other commercial herbal products containing two or more herbs (please give the product name in the text box)
- ☐ Rongoā
- ☐ Other

Please indicate the main reason for taking this/each product

	General support of breastfeedin	To encourage my milk to come in	To increase milk supply	To improve milk quality	To give me more energy
» Domperidone	○	○	○	○	○
» Lactation cookies	○	○	○	○	○
» Complan	○	○	○	○	○
» Brewer's yeast	○	○	○	○	○
» Fenugreek	○	○	○	○	○
» Blessed thistle	○	○	○	○	○
» Milk thistle	○	○	○	○	○
» Fennel	○	○	○	○	○
» Oats	○	○	○	○	○
» Nuts and seeds (e.g. almonds, flaxseeds etc.)	○	○	○	○	○
» OTC (over the counter) naturopath and/or homeopath remedies	○	○	○	○	○
» Breastfeeding tea/lactation tea	○	○	○	○	○
» Naturopath or homeopath remedies prescribed by practitioner	○	○	○	○	○
» Other commercial herbal products containing two or more herbs	○	○	○	○	○
» Rongoā	○	○	○	○	○
» Other	○	○	○	○	○

When did you begin using this/these products?

	Before the baby was born	In the first week after birth	< 1 month post-partum	< 2 months post-partum	2 or more months post-partum
» Domperidone	○	○	○	○	○

	Before the baby was born	In the first week after birth	< 1 month post-partum	< 2 months post-partum	2 or more months post-partum
» Lactation cookies	○	○	○	○	○
» Complan	○	○	○	○	○
» Brewer's yeast	○	○	○	○	○
» Fenugreek	○	○	○	○	○
» Blessed thistle	○	○	○	○	○
» Milk thistle	○	○	○	○	○
» Fennel	○	○	○	○	○
» Oats	○	○	○	○	○
» Nuts and seeds (e.g. almonds, flaxseeds etc.)	○	○	○	○	○
» OTC (over the counter) naturopath and/or homeopath remedies	○	○	○	○	○
» Breastfeeding tea/lactation tea	○	○	○	○	○
» Naturopath or homeopath remedies prescribed by practitioner	○	○	○	○	○
» Other commercial herbal products containing two or more herbs	○	○	○	○	○
» Rongoā	○	○	○	○	○
» Other	○	○	○	○	○

Once begun, how long did you continue to use these products during breastfeeding?

	Less than 1 week	1-2 weeks	>2 weeks-1 month	>1-3 mos	The entire time I was breastfeeding	On and while breastfee
» Domperidone	○	○	○	○	○	○
» Lactation cookies	○	○	○	○	○	○
» Complan	○	○	○	○	○	○
» Brewer's yeast	○	○	○	○	○	○

	Less than 1 week	1-2 weeks	>2 weeks-1 month	>1-3 mos	The entire time I was breastfeeding	On and while breastfee
» Fenugreek	○	○	○	○	○	○
» Blessed thistle	○	○	○	○	○	○
» Milk thistle	○	○	○	○	○	○
» Fennel	○	○	○	○	○	○
» Oats	○	○	○	○	○	○
» Nuts and seeds (e.g. almonds, flaxseeds etc.)	○	○	○	○	○	○
» OTC (over the counter) naturopath and/or homeopath remedies	○	○	○	○	○	○
» Breastfeeding tea/lactation tea	○	○	○	○	○	○
» Naturopath or homeopath remedies prescribed by practitioner	○	○	○	○	○	○
» Other commercial herbal products containing two or more herbs	○	○	○	○	○	○
» Rongoā	○	○	○	○	○	○
» Other	○	○	○	○	○	○

If there is anything else you would like to tell us about the use of foods, herbs, Rongoā or other medicines to support breastfeeding, please do it here.

Did you make any other changes to what you eat and drink while breastfeeding?

- ○ No
- ○ Yes

What changes did you make to your diet and why did you make them?

experience breastfeeding

Overall, how would you describe your experience with breastfeeding this child

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Starting off breastfeeding was easy	○	○	○	○	○
I had a lot of support to start breastfeeding	○	○	○	○	○
Breastfeeding got easier as she/he got older	○	○	○	○	○
I have learned a lot breastfeeding this child	○	○	○	○	○
Breastfeeding this child has been hard work	○	○	○	○	○
I was determined to breastfeed this child	○	○	○	○	○
I think my breastmilk is good quality	○	○	○	○	○
My baby is/was generally satisfied after breastfeeding	○	○	○	○	○
My family/friends have questioned the adequacy of my breastmilk to nourish my baby	○	○	○	○	○
Health professionals have been supportive of my breastfeeding my baby	○	○	○	○	○
Overall, breastfeeding this baby has been successful	○	○	○	○	○

Overall, how would you describe your experience with breastfeeding this child?

Birth information

*Now we would like to ask you some questions about your labour and birth, and early hours after birth. If you have more than one child, please give the information about **your youngest child**.*

What was your baby's birth weight? (Please enter as grams, e.g. 3560.)

Was your baby born before 36 weeks gestation?

- O Yes
- O No

Did you have caesarean delivery?

- O Yes
- O No

Were any of the following medications used during the labour and birth? (Mark **all** that apply to you.)

- ☐ Didn't use any medications
- ☐ Don't know if I used anything
- ☐ Pain relief (including oral, injection and gas)
- ☐ Epidural
- ☐ Drugs to induce labour
- ☐ Sleeping tablets
- ☐ Other

When was your baby put to your breast after birth?

- O Unsure

- ≤ 1 hour
- 1-2 hours
- 2-5 hours
- 5 hours+

Did you (or anyone else) hold your baby skin-to-skin within 30 minutes of birth?

- Yes
- No

Were you and your baby separated in the first week after birth? (e.g. baby was admitted to the neonatal care unit, mother had surgery, etc.)

- Yes
- No

Demographics

Lastly, we would like to ask a few questions about you.

How many children do you have?

- 1
- 2
- 3
- 4 or more

Did you breastfeed your other child(ren)? (No matter how long you breastfed that child. Fed with expressed milk from you is also considered as breastfeeding.)

- No
- Yes, some of them
- Yes, all of them

Did you ever question if your milk supply was enough/good enough when you breastfed your other child(ren)?

- No, I made too much milk
- No, my milk supply and/or quality was good enough
- Yes, for once or twice I had the thought that my milk supply and/or quality was not good enough
- Yes, I worried my milk supply and/or quality not being good enough in some specific period of time (e.g. first few weeks after birth, growth spurts, etc.)
- Yes, I always worry about my milk supply and/or quality not being good enough

- ○ Can't remember

Did you ever take any medications, supplements, herbs/herbal products, foods/drinks or Rongoā with the purpose of supporting breastfeeding, influencing your milk **supply** or milk **quality** when you breastfed your other child(ren)?

- ○ No
- ○ Yes
- ○ Can't remember

What is your age?

Which Ethnic group(s) do you belong to? (Mark **all** that apply to you.)

- ☐ New Zealand European
- ☐ Māori
- ☐ Samoan
- ☐ Cook Islands Māori
- ☐ Tongan
- ☐ Niuean
- ☐ Chinese
- ☐ Indian
- ☐ Other (e.g. Dutch, Japanese, Tokelauan), please state:

What is the highest level of education you have completed?

- ○ No secondary school qualification
- ○ Secondary school qualification or NCEA 1-3 or NZQF 1–4
- ○ Diploma or Trade Certificate or NZQF 5–6
- ○ Bachelors Degree or NZQF level 7 qualification
- ○ Higher Degrees (postgraduates, masters, PhD)

Who are you currently living with? (Please mark **all** that apply to you.)

- ☐ My partner/spouse
- ☐ Child(ren)
- ☐ My parent(s)
- ☐ My partner's parent(s)
- ☐ Just myself and my baby
- ☐ My flatmate(s)

☐ Other, please state who

What is your total annual household income AFTER tax?

- ○ < $20,000
- ○ $20,000-$50,000
- ○ $50,001-$80,000
- ○ $80,001-$120,000
- ○ >$120,000
- ○ prefer not to say

Thank you for completing the survey. Please add any information you would like to share about your breastfeeding experience.

Then select 'submit' to close the survey. You will be directed to a new form to enter the prize draw.

☐ Is there anything else you would like to say?

☐ Submit, to complete the survey.

Thank you for completing the survey.

If you would like to go into the prize draw and/or get a copy of the results please click this **link** and you will be directed to a new form to leave your details.

Appendix E. Prize draw survey

Default Question Block

Thank you for completing the Breastfeeding in New Zealand survey. Would you like to

- ☐ enter the prize draw
- ☐ be emailed a copy of the results

Please leave

Your name

Your email

Powered by Qualtrics

Appendix F. Other foods specified by participants as being consumed to support breastfeeding

OTHER FOODS	# of times mentioned
lactation hot choc	7
water	8
milo	6
Powerade	1
mamas milk bar	7
higher protein diet	3
electrolytes	9
calcium	1
magnesium	2
vitamin d	1
homemade cookies	2
protein powder	1
beer	3
high dose garlic supplement	1
sunflower lecithin	6
malt drink	1
vitamin B	1
Nifedipine	1
probiotics	2
ice cream	1
fish broth	1
seaweed soup	3
coconut water	1
cranberry juice	1
Elevit	3
nutrient rescue red shot	1
benedictine	1
milk collective drink	1
Nutri grain	1
raspberry leaf tea	1
cow's milk	2
soy milk	1
red dates	1
dried longan tea	1
chicken essence	1
beef broth	1
iron rich foods	1

moringa	2
organ supplement	
goats rue leaf tea	
multivitamin	
fish oil	
iodine	
coconut water with semolina	
bananas	