Hochschule für angewandte Wissenschaften Hamburg
Life Sciences Bergedorf
Ökotrophologie/Ecotrophology

BACHELOR THESIS

A systematic Review about Baby-led Weaning

Author: **Helena Mai Jacoby**

Matriculation No.: **2116693**

Assessor: **Prof. Dr. Joachim Westenhöfer**
Second Assessor: **Prof. Dr. Sibylle Adam**

Place of Publication: **Hamburg**
Submission Date: **01.02.2016**
Editing Time: **8 weeks**

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Abbreviations

BLISS	Baby-led Introduction to solids
BLW	Baby-led Weaning
CFQ	Child Feeding Questionnaire
GMS	Gateshead Millennium Study
HP	Healthcare Professional
SD	Standard Deviation
SES	Socio-economic Status
SW/ TW	Standard Weaning/Traditional Weaning

Introduction

Undoubtedly, the weaning period, including the first introduction of complementary foods, is a crucial time in an infant's life. Not only does it involve a great deal of imminent change for the child, but its timing and implementation is also associated with the development of eating behaviours, food preferences and body weight in early childhood and maybe even adolescence and adulthood (Brown & Lee, 2015) (Townsend & Pitchford, 2012)(Ventura & Birch, 2008)(Benton, 2004). Indeed, how a child is weaned and introduced to solid foods might actually have an influence on their entire life.

The usual method for introducing complementary foods to infants that is recommended to mothers in most countries is traditional weaning, i.e. spoon-feeding the child mashed or puréed food before a gradient transition to finger foods and family foods takes place as the child grows (World Health Organization, 2009) (New Zealand & Ministry of Health, 2012).

Recently, an alternative weaning method called baby-led weaning (BLW) has become more popular in the UK (Brown & Lee, 2011a) (Brown & Lee, 2011b) and New Zealand (Cameron et al., 2012). Anecdotal evidence suggests that many mothers attempt this approach (Sachs, 2011). It is therefore necessary to address the potential risks of this method and weigh them against the possible advantages.

Instead of spoon-feeding the infant BLW advises parents to encourage their children to self-feed after an exclusive breast feeding period of six months, gradually introducing finger foods once the infant shows certain signs implying that they are ready for the transition. BLW in its purest form does not include any spoon-feeding whatsoever but rather emphasizes that the child itself should be the only one putting food in its mouth (Rapley, 2011).

While the existing research suggests that BLW is feasible for most six-months-old from a motor development point of view (Wright et al., 2010) and is associated with certain advantages like lower levels of maternal control and maternal anxiety during the complementary feeding period (Brown & Lee, 2011b) and perhaps healthier eating habits and BMI (Townsend & Pitchford, 2012), this method is also cause for concern in parents and healthcare professionals. The most common perceived risks of BLW are the risk of choking, inadequate energy intake and low iron-status (Cameron et al., 2012).

This thesis aims to analyse and summarize the current state of research concerning the subject of baby-led weaning and the correlating advantages and risks in order to conclude if this alternative

method of introducing complementary foods is feasible as well as advisable for parents and their children.

This paper is segmented into three main parts. While the first part explicitly explains the concepts of baby-led weaning and its opposing method traditional weaning including perceived advantages, problems and compliance with general feeding recommendations, the second part emphasizes on existing studies and research papers found in the medical database PubMed when entering the key word “baby-led weaning”. Lastly, the final section entails a discussion of the scientific insights leads to a differentiated conclusion, taking into account the limitations of the actual body of research and phrasing important questions concerning BLW that still need answering, therefore declaring a further need for exploration.

1 Baby-led Weaning

1.1 What is Weaning?

1.1.2 Definition of Weaning

The term weaning describes the time period in which a continual reduction of breast-feeding or the feeding of infant-formula takes place while the infant is gradually introduced to complementary foods to replace the former milk intake. The weaning process progressively leads to the implementation of a dietary pattern that is customary in the infant's family during the second year of the child's life (European Food Safety Authority, 2009).

1.1.3 Traditional Weaning

Traditional or standard weaning (TW or SW) usually consists of a parent or caretaker spoon-feeding the child with mashed or puréed foods along with a gradual introduction of finger foods (Seaman, D'Alessandro, & Swannie, 1996). The first introduction of complementary foods normally starts with a rather thin purée and then, according to age and developmental progress of the infant, is being offered in a more lumpy consistency as a transition to normal family foods. As puréed baby food often consists of more than one ingredient, the tastes of the single foods, like different fruits or vegetables, are blended together and not necessarily distinguishable for the child (Brown & Lee, 2015).

Parental control is high when using a TW approach. That means that the parent spoon-feeding the child is basically in control of the portion size and there is no or limited food choice for the infant. These circumstances urge the child into a passive role while the feeding takes place, as the infant has little or no decisions to make (Brown & Lee, 2011b).

Especially when introducing solid foods early, i.e. before the baby is six months old, TW is the method of choice as a child this young is not developmentally ready to eat and ingest whole foods. The reasons for an early introduction can be e.g. perceived hunger of the infant, not knowing the actual guidelines and recommendations, relying on questionable information from the internet, advice from friends and family, health or convenience reasons (Caroli et al., 2012).

1.1.4 Weaning Recommendations

The World Health Organization (WHO) states breastfeeding as the optimal method to provide the best possible nutrition to infants while at the same time benefitting the health of the Mother. The WHO therefore recommends exclusive breastfeeding for the first six months of a child's life to achieve optimal growth and development, as well as complementary breastfeeding until two years of age or beyond (World Health Organization, 2002).

When it comes to the introduction of complementary foods the WHO sets the focus on four particular aspects pertaining to those foods. The WHO states complementary foods should be timely, adequate, safe and properly fed, meaning that the introduction takes place when the need for nutrients and energy of the child can no longer be provided by breastfeeding exclusively and should include foods that provide the necessary energy and nutrients needed for growth and development. Furthermore, it requires that those foods are hygienically prepared and fed with clean hands and cutlery, are provided according to the child's appetite, and that the feeding method and meal frequency is suitable for the child's age. (World Health Organization, 2002)

When first solid foods are introduced, parents are advised to feed their children iron rich foods from the first introduction onwards, especially if the introduction takes place at the recommended age of six months as the iron content of breastmilk is decreasing over time (World Health Organization, 2009).

The usual method for introducing complementary foods that is recommended to mothers in most countries (including the United Kingdom and New Zealand) is traditional weaning, i.e. spoon-feeding the child mashed or puréed food before a gradient transition to finger foods and family foods takes place as the child grows (World Health Organization, 2009) (New Zealand & Ministry of Health, 2012) (Department of Health, 2003). Regardless of the content of existing guidelines, in many countries the actual duration of breastfeeding and the timing of introduction of complementary foods is deviating from the recommendations (Caroli et al., 2012).

Recently another method of introducing complementary foods is becoming more popular: Baby-led weaning (BLW) (Brown & Lee, 2011a, 2011b, 2013) (Sonya Lynne Cameron et al., 2012). Although BLW is not especially mentioned in the WHO's and other health administration's recommendations, it seems to be aligning with the key aspects of weaning and child nutrition recommendations as is to be examined in the following.

1.2 Baby-led Weaning

1.2.1 What is BLW?

Baby-led weaning (BLW) is an alternative approach on introducing complementary foods to infants in which the baby is allowed to direct and control the process (hence the term "baby-led"). That means that although parents decide which foods to offer, the child decides what and how much to eat (Rapley, 2011).

The key aspects of BLW are that the baby participates in family mealtimes, is offered the same food as the family in a form that is appropriate for their level of development (meaning the size and consistency of food pieces) and they feed themselves from the very beginning (Rapley, 2011). BLW in its purest form does not include any spoon-feeding of the adult whatsoever (Cameron et al., 2012). At the same time breastfeeding continues on demand, meaning that the infant is given breastmilk according to their hunger and appetite cues.

This particular method was first scientifically brought to the surface by Gill Rapley in the early 2000s and has since then increased in prominence and popularity (Brown & Lee, 2011a, 2011b, 2013) (Cameron et al., 2012). Rapley (2011) emphasizes that this method is not new but has probably been around for a very long time. Even in commercialized countries like the UK especially families with three or more children have already followed this method before the term Baby-led Weaning was established. She says that by giving this natural and logical approach a name it was made describable for parents who already used it instinctively and made accessible for parents who had not heard of or tried this approach before.

1.2.2 Practical tips for using BLW

In her books, Rapley (Rapley & Murkett, 2008, 2010) provides a plethora of practical tips for parents using a BLW approach that are intended to improve convenience, healthiness and safety of this method. These tips include that the meals provided for the infant (and the family) should be healthy and nutritious, being cooked "from scratch" without any processed foods or products wherever possible. Parents are also advised to avoid added salt and sugar, as well as honey,

shark, shellfish, marlin and undercooked eggs for health reasons as they can be hazardous for the small and undeveloped body of a baby.

Rapley advises parents to make sure their child is not hungry or sleepy at mealtimes, so that they can concentrate on exploring food as a new experience (that will only much later be linked to satiety). They should be sitting upright and be supported if necessary so they can freely use their arms and hands in order to grab food and bring it to their mouth.

In order to avoid waste the floor can be covered with a clean plastic sheet or something similar so food that falls down can be handed back to the child. This also makes the cleaning process much easier afterwards.

The foods offered should be prepared so they can be picked up and held easily and should gradually be introduced in a broader variety of textures, colours and shapes to promote motor skill development, a healthy diet and keep mealtimes interesting. Rapley recommends foods like soft fruit, softly cooked vegetables, strips of meat, toast or cheese as suitable first foods. Hard foods, especially small and roundly shaped like nuts, should be avoided due to the risk of choking. Small round foods like grapes or cherry tomatoes should be cut in half before offering them to the child.

Milk-feeding should continue on demand in between the shared family meals. When their intake of solid foods increases, the baby will automatically reduce the intake of breastmilk, gradually weaning themselves. At the same time water should be offered at mealtimes to ensure sufficient hydration.

Finally, Rapley emphasizes that it should be made sure nobody except the baby themselves puts food into the infants mouth (e.g. other toddlers, friends, grandparents etc.) and that the child should never be left alone with food.

1.2.3 Possible Advantages of BLW

Using a BLW-approach has many possible advantages. First of all the principle of letting the child decide what and how much to eat is similar to the method of breastfeeding on demand (Sachs, 2011). At the same time BLW encourages parents to exclusively breastfeed for six months and might therefore lead to a longer exclusive breastfeeding period (Moore, Milligan, & Goff, 2014). That may be beneficial because a prolonged breastfeeding duration (Harder, 2005) and a later introduction of solids (Moorcroft, Marshall, & McCormick, 2011) have been shown to have an

protective affect against the risk of childhood obesity. Breastfeeding gives the infant the opportunity to regulate their own energy intake via the amount of milk they drink (Bartok & Ventura, 2009), therefore breastfeeding may positively influence the satiety-responsiveness in young children (Brown & Lee, 2012). At the same time breastfeeding exerts a low level of maternal control (Brown, Raynor, & Lee, 2011) while BLW also encourages parents to be less controlling. This might be beneficial as a controlling parental feeding style has been shown to be a risk factor for poorer appetite regulation, which could lead to an increased risk of developing obesity (Ventura & Birch, 2008) (Benton, 2004). Most times parental control is expressed in either restricting the intake of food or exerting pressure to eat. Both of these parental feeding styles have been linked to negative eating behaviour in the child. While the restriction of food-intake can lead to increased intake when there is free access to food (Joyce & Zimmer-Gembeck, 2009) and therefore promote weight gain (Faith et al., 2004), pressuring a child to eat can lead to increased fussiness (Galloway et al., 2005) (Farrow, Galloway, & Fraser, 2009). However, when using a BLW approach parental control is minimal, as the infant decides what food items they will eat, how much of it at what speed (Brown & Lee, 2013).

The BLW approach not only suggests exclusive breastfeeding for 6 months and further breastfeeding on demand, it also takes pressure of the parents to introduce solid foods early, i.e. introduction is suggested after six month but it is advised not to pressure the child in any way, while at the same time BLW implies it is not entirely necessary that the infant ingests a lot of solid foods before one year of age („Food until one is just for fun“)(Arden & Abbott, 2014).

As food does not come mashed together as is usual when using a traditional weaning-approach, BLW provides the opportunity to experience single flavours and textures. Therefore this method might provide an early and more stable learning about the satiating capacities of foods and therefore enable better satiety-responsiveness (Brown & Lee, 2015).

1.2.4 Problems and concerns about BLW

Although many parents, especially in New Zealand, the United Kingdom and Canada seem to be interested or are already following a BLW approach, the government and healthcare professionals in these countries currently hesitate to recommend this feeding style. This is due to major concerns such as iron adequacy, energy intake and choking risk.

Energy density is conceived a problem, because parents who do not know which finger foods are suitable for their child might only feed fruit and vegetables, which are low in energy. If this leads to the child not getting the required energy from the food eaten this may result in growth faltering. Additionally, most fruit and vegetables are also low in certain minerals like iron, so an exclusive consumption of these foods might lead to a suboptimal iron status (Cameron, Heath, & Taylor, 2012).

Although healthy infants with a normal birthweight are considered to be getting sufficient iron from being fed breastmilk and from the redistribution of iron from haemoglobin to iron stores during the first six month of life (Domellöf, 2011) (Kramer & Kakuma, 2002), in the second half of their first year iron becomes a critical nutrient for the child, what makes an early introduction of iron-rich foods so important (Anderson & McLaren, 2009) (World Health Organization, 2002). While Iron intake of infants is a mayor issue worldwide as it is (Chaparro, 2008) in many countries (including NZ and the UK) it is customary to feed iron-fortified baby-cereal as one of the first introduced solid foods. Due to its semi liquid consistency though, iron-fortified baby-cereal is not suitable for BLW, because it would require spoon-feeding (Cameron, Taylor, & Heath, 2015). If parents using a BLW approach do not know which iron-rich finger foods they can safely feed their children, it would mean that infants raised using BLW would be at an increased risk of iron deficiency.

Furthermore, the risk of choking is a general concern with infants and small children as well. Some foods like hard small foods (e.g. Nuts) and roundly shaped foods (e.g. grapes) are highly associated with even fatal choking in small children and should therefore be excluded from an infant's diet (Hayman et al., 2013). It is questionable if following BLW creates a higher choking risk than TW, provided that parents feed only finger foods that are considered safe and appropriate for their infant's level of development.

Another question raising itself about baby-led weaning is its feasibility. Is this feeding method suitable for the general population? Is it convenient? Is it easy to understand and to conduct? If this method shows to be more complicated, messy or expensive than the traditional approach, it is unlikely to be established in society and hard to recommend, even if there should be prominent advantages.

In the following, actual research literature about baby-led weaning is to be summarized and discussed in order to weigh the risks and advantages of this method against each other.

2 Research about BLW

2.1 Literature

2.1.1 Search Technique

The literature used in this thesis was found via searching the medical database PubMed for the term “baby-led weaning” in September 2015. Further literature, which was either send via e-mail by Gill Rapley or found through citations in the mentioned PubMed results, was used additionally throughout this thesis.

2.1.2 Literature Selection

There were 20 results found in the PubMed database and then sorted into reviews or papers and actual studies, leading to a total of 3 reviews, 1 editorial and 16 studies of which one was not being able to be acquired and one containing the search word “baby-led” but not being about baby-led weaning (Anderson et al., 2001) leaving a total of 14 studies to be examined in this second part of the thesis.

2.2 The existing Body of Research ordered by Year of Publication

2.2.1 2010

In a study conducted in 2010 **(Wright et al., 2010)** the feasibility of baby-weaning was analysed using statistics from the Gateshead Millennium Study (GMS), a population based cohort study in north-east England that has been started in 1999 and has its focus on growth and development in childhood with a special interest in feeding. GMS recruited infants just after birth and prospectively observed them via postal questionnaires (Parkinson et al., 2011). Using GMS data the authors of the study examined the range of ages at which infants reach out for finger foods and when they first eat them. This information was then linked to the developmental status of the children.

Of the 1029 children who were recruited for GMS 923 were eligible for this study. Infants born before 37 weeks of pregnancy and children from Haredi Jewish families were excluded (the latter were excluded because they had been found to have growth patterns deviating from the usual).

Of the children included 609 had feeding data available at eight months. Of those 609 children 336 (57%) have been breastfed for a certain time, but only 124 (21%) were breastfed for more than 4 months. 602 infants had data on the first occasion they reached out for food. 340 of them, which equals 56%, had done so before the age of six months, while 36 or 6% still had not reached out for food at the age of eight months. The first consumption of finger foods was found to be unrelated to breastfeeding occurrence and duration.

The infant's behaviour towards food was also linked to their general level of development. At the age of one year for 510 infants whose feeding data was completed earlier the parents reported whether their child was already walking and for 506 of those children it was reported if they could yet say words with actual meaning. It was found that the point of time a child first reached out for food was related to the level of development at 12 months. The children who did not reach out for finger foods before six months were significantly less likely to be walking unaided and speak words with meaning at the age of one year.

447 parents completed a diary of the first five occasions their baby had finger foods additional to the normal feeding questionnaire. They reported the date, the type of food as well as the amount taken and freely described their child's reaction to the food. In result, 170 (40%) of the children had their first finger food before six months, 383 (90%) made this experience before the age of eight months. Most common first foods were bread or biscuits in some form, while on the first offer 20% of foods were fruit or vegetables, 2% were meat and 5% were confectionary.

There were 604 children with information on their current food intake at the age of eight months. At this point all but 58 (9,6%) of them were having finger foods at least once a day, but only 309 (51%) were having finger foods several times a day, meaning that the main source of complementary foods at the time was spoon-feeding.

The study concludes that baby-led weaning is probably feasible for most infants. It concludes parents should probably be advised that BLW is reasonable only if their child is reaching out and mouthing objects at the age of six months. The study emphasizes that BLW could be problematic for children who are developmentally delayed compared to the majority of infants their age. The authors note that probably the most practicable approach would be to adopt the advantageous aspects of BLW (promoting self-feeding of finger foods and shared family meals at an early age) without going to extremes, meaning to allow some spoon-feeding if necessary.

2.2.2 2011

In 2011 Gill Rapley, who is known to be the research pioneer on the topic baby-led weaning, published a paper aiming to revive practitioner's knowledge about complementary feeding practices and explain the key features of baby-led weaning **(Rapley, 2011)**. In this paper she examined evidence which supports the BLW approach as a logical alternative to traditional weaning and supports the introduction of solid foods at the age of six months.

After explaining Baby-led weaning and its key features (shared mealtimes, baby eating family foods, baby feeding themselves and breastfeeding continuing on demand) Rapley explains that hunger is unlikely to be the initial reason for infants showing interest in solid foods. They merely show interest in sharing their parent's activity and then, when they are allowed to handle and explore foods with their mouths, they will over time learn how to bite, chew and swallow and after some time eventually learn that food satiates them. That means that the first weeks of weaning are mainly a time for exploring different textures and tastes, while breast milk still is the main source of nourishment and will be until the baby is around one year old.

Rapley says that in order to learn proper chewing and self-feeding skills, a baby needs frequent opportunities to practise. She claims that there is no research to support the feeding of purées to normal, healthy six months old infants, but on the other hand emphasizes that the critical time period for acquiring chewing skills is from six to nine months and that babies who are not given more textured or more lumpy foods than purées by the time they reach ten months are more likely to be "difficult to feed" as toddlers (Northstone et al., 2001). By giving the baby time and opportunity to explore and handle food without any exerted pressure, baby-led weaning aims to support infants in making a gradual transition to solid foods in their own time.

In her paper Rapley also responds to the most commonly expressed concerns about BLW being sufficient energy intake, iron intake and choking risk. She makes it clear that a parents expectations what their child will eat in solid foods between six and twelve months is much higher than what the infant really needs and that a rapid increase in solid foods will lead to an automatically decreased intake of breast milk that is not beneficial for the child's development. Breast milk should continue to play a large role in the babies' nutrition until it is one year old and therefore babies should not consume large quantities of solid foods before that age. Because BLW allows the child to be in control of what and how much they eat, overfeeding is almost impossible and therefore BLW gives parents and healthcare professionals the opportunity to learn how much food babies really need.

While many healthcare professionals have concerns about the adequate iron intake when following BLW, Rapley disputes healthy infants being fed by BLW guidelines being at increased risk for iron deficiency. She claims as the gut of a six months old infant is more developed than a four months old, for which most existing traditional feeding recommendations were established, they can be fed iron rich foods like eggs and meat from the very start. Infants being fed on a BLW approach therefore have, in addition to breastmilk that is containing iron in low, but biologically available levels, excellent iron sources at hand.

Another frequently expressed concern is the risk of choking. Choking occurs to adults and children alike and happens when the coordination of swallowing and breathing is disturbed. Reasons for this can e.g. be wrong posture of the body (e.g. leaning back), lack of concentration or wrong eating technique. It has been shown that babies who are introduced to complementary foods in form of spoon-fed purées before they are able to bite and chew, they use suction to get the food of the spoon (Naylor & Morrow, 2001), which rapidly pushes the food to the back of the throat for swallowing. Rapley therefore claims that the feeding of puréed foods encourages babies to swallow food without chewing and might put the child at a greater risk of choking than the self-feeding of finger foods, where bitten of food pieces stay at the front of the mouth and help the baby to learn how to chew. She explains while choking is uncommon when using BLW, gagging is a common phenomenon. She explains gagging as a safety mechanism that helps to prevent choking, as it results in pieces of food that are yet too big to be swallowed are returned to the front of the mouth for further chewing. In six months old children the gag reflex is much further forward in the mouth than in older children and over time moves backward during the first year of age (Naylor & Morrow, 2001). Rapley claims that most babies being fed using a BLW approach gag a lot when first starting solids but over time gag less and less, which indicates that the gag reflex helps babies in learning oral motor skills and ensures their safety when eating solid foods. As most parents experience stressful emotions when their child is gagging, the babies themselves do not seem to be bothered by this natural mechanism.

Finally, the author concludes that normally developed infants can safely transition to solids without needing puréed foods. As an alternative, babies can safely be allowed control of what and how much they eat, enabling a transition to solids at their own pace supported by ongoing breastfeeding on demand. Rapley evaluates BLW as less stressful for the parents, making mealtimes fun for the child, while families can have shared meals and parents have less mealtime preparations, while anecdotal reports suggest that BLW might have advantages like fewer mealtime battles, less fussy eating and better appetite regulation in early childhood, although

further research is needed to confirm these.

Also in 2011, a descriptive study was conducted which aimed to characterize a sample of mothers who followed a BLW approach and compare them to traditionally weaning mothers **(Brown & Lee, 2011a)**. For this purpose 655 women with a child between six and twelve months were interviewed via online questionnaire about their demographic background, the timing of introduction of complementary foods, the use of spoon-fed purées and their experiences during weaning and mealtimes.

The mothers in the study were not asked to identify themselves as following BLW. Instead, as there is no official definition for BLW, the participants were asked to estimate the use of spoon-feeding opposed to self-feeding and the amount of puréed foods given during the weaning period in percent. In this study the participants were classified as users of BLW if spoon-feeding or use of purées took place less than or equalling 10% of the time. In total, 52% were classified as using BLW based on spoon-feeding and 57% were classified using BLW based on purée use, while the rest of participants were classified as using standard weaning. Furthermore, mothers who returned to work before their child was 12 months old were additionally asked about the feeding style and type of food given to their infant in child care.

Participating mothers were also given a short description of BLW and were asked if they had heard about this method before. Of the 655 mothers in the study only 17 (2,6 %) had never heard of this method, while 384 (58,2 %) considered themselves well informed about BLW. The degree of knowledge about BLW could statistically be linked to use of spoon-feeding and purée use: the more mothers knew about BLW, the less they spoon-fed their children or used purées.

The study was able to make a number of important comparisons between mothers using a BLW and mothers using an SW approach.

Firstly, there were significant links found between demographic data of the participating mothers and the weaning style they used for their children. The use of spoon-feeding puréed foods was inversely associated with higher maternal education, the type of maternal occupation und marital status. It was found that mothers who allowed their children to self-feed and gave finger-foods frequently had significantly longer education, were more often married and in a professional or a managing occupation than women who spoon-fed their children, while being less likely to be returning to work before their baby was one year old. For maternal age, income and home ownership however, no significant association was found. At the time the study was conducted information about BLW was not to be retrieved using mainstream sources for feeding

information (i.e. advice of healthcare professionals or popular literature on the subject). This might explain why mothers with higher education know about and use this method more often, as they are also better suited to get information about it, because higher education tends to lead to increased internet access.

Mothers using BLW introduced solid foods significantly later that those following an SW approach, while the mean age of children being fed using BLW was closer to the recommended age of six months (World Health Organization, 2002). At the same time mothers who were identified as users of BLW were more likely to offer fresh and home-made foods as first foods and were more likely to participate in mealtimes, which both are important aspects of the BLW method's concept. In this study infants who receive purées and/or are spoon-fed were less likely to sit with the family and mealtimes and if they did, they were significantly less likely to be eating the same foods as the rest of the family. Of those children who did consume family foods, infants who were spoon- and purée-fed more often were also more likely to receive their family foods in mashed or puréed form instead of being given whole or finger-foods and it was also more likely for them being spoon-fed those mashed or puréed foods by a family-member instead of feeding themselves. It was also found that parents who spoon-fed and used purées more used set feeding schedules for introducing solid foods significantly more often.

The questionnaires in the study also asked participants about breastfeeding and formula use. The results showed mothers who were identified as users of BLW breastfed for a significantly longer time period than users of SW, although only 218 (33 %) mothers were still breastfeeding when they completed the questionnaire.

While mothers who used spoon- or purée-feeding for the most time reported more frequent complementary meals during the day than followers of BLW (3,25 opposed to 2,23 mean meals per day), they also reported less milk feedings during the day as well as during night-time. These relationships were not linked to breastfeeding duration. At the same time infants that were being spoon- or purée-fed more were estimated to actually swallow greater quantities of food than infants whose parents followed the BLW method. Additionally there was found a positive relationship between the mother's anxiety about the child's nutrient-intake and the use of spoon-feeding and purées. Moreover, mothers who reported a bigger proportion of spoon-feeding or purée-use also reported being concerned about the mess created during the feeding process more often. Mothers who used a more baby-led feeding style were feeling more confident during mealtimes, were less anxious about nutrient-intake and less concerned about

the mess created, though there was no association found between the feeding style and the level of enjoyment the parents and the child felt during mealtimes.
Finally, the participants in this study reported their preferred sources of information about complementary feeding. The three main sources used were support from family-members, support from healthcare professionals or support from external sources (i.e. the internet, books, friends etc.). While mothers with a high proportion of spoon-feeding or purée use were likely to seek advice from healthcare professionals, mothers following a BLW approach more often used other sources while seeking less advice from healthcare professionals.
There are some limitations that need to be considered when evaluating the results of the study. First off, although a large sample was taken, the participants were self-selected and partly recruited via internet, a method that is efficient but criticized for attracting participants who are educated above average (Gosling et al., 2004). However this study provides a solid basis for a further exploration of the issues being raised about BLW. As the study was cross-sectional it does only picture a snapshot in time of the behaviours and attitudes concerning the different feeding styles. It is possible that factors like maternal anxiety or the desire to introduce complementary foods early prevent parents from following a BLW approach instead of BLW resulting in the absence of these emotions. Secondly, while mothers reported how much food their infant actually consumed by swallowing, this information was estimated and no actual measure of food intake took place. Therefore there can be no conclusion about the amount of energy and nutrients being consumed and further research is needed to determine the nutrient and energy intake of infants on different weaning approaches and the short-term and long-term impact of the differences between the feeding styles. Also, the suitability of BLW for infants who experience feeding or weight problems, as well as developmentally delayed infants, remains unclear.

In the same year Brown and Lee published another study to investigate the influence of the maternal feeding style on child eating behaviour and child weight during the weaning period **(Brown & Lee, 2011b)**. It has already been shown before that a maternal feeding style that is high in control can have a negative impact on child weight and eating behaviour in children over 12 months of age (Ventura & Birch, 2008), while the influence of the feeding style during the introduction of complementary foods has not been explored yet.
This cross-sectional study examined the differences in maternal feeding style between mothers who follow a traditional weaning approach and mothers who follow BLW. For this purpose, 702

mothers with a child aged six to twelve months completed the Child Feeding Questionnaire (Birch et al., 2001) as well as providing information about their chosen weaning approach, infant weight and perceived size via online questionnaire.

As one of the key features of BLW is to encourage self-regulation of food-intake by the baby themselves with little or no parental intervention, the authors predicted that BLW would be associated with a maternal feeding style that is low in control compared to traditional weaning. The influence of maternal and infant weight upon the weaning process was examined as well. Like in their previous study (Brown & Lee, 2011a) the authors asked the participants to estimate their use of spoon feeding and puréed foods in percent to classify mothers as BLW (spoon-feeding and purée-use 10 % of the time or less) or SW (more than 10 % of the time) users. The reason for this classification is the lack of an official definition for the BLW method and additionally it allows mothers who predominantly follow BLW guidelines but occasionally use spoon-feeding or purées (e.g. when the child is sick) to be classified as BLW as well.

To acquire the necessary information participants completed the Child Feeding Questionnaire (CFQ) which includes parental beliefs, attitudes and practises towards their child's nutrition. It aims to explore different aspects about child feeding like parental control over the child's diet, restriction, pressure to eat, monitoring, concern for the child's weight, the use of food for rewards etc. (Birch et al., 2001). Although the CFQ was designed for children between two and eleven years of age, the questions were appropriate for examining the introduction or complementary foods, although some inapplicable questions were excluded in this study (e.g. questions that concerned child weight over the age of twelve months). Additionally, participants stated their current and prenatal weight and height as well as their infant's birth weight, an estimate of infant weight at 6 months and the current weight for the point of time they completed the questionnaire. Furthermore, mothers in the study reported their perception of how much their baby had grown during the first six month using a five point Likert scale (much smaller than average, smaller than average, average, larger than average and much larger than average).

After an exclusion of participants who gave incoherent information regarding spoon-feeding and purée use, of the remaining 604 women 351 (58,1 %) were classified as following BLW and 253 (41,9 %) as users of SW. It was found that mothers that used BLW had significantly higher levels of education, a professional or managerial job and were less likely to have returned to work at the time of filling in the questionnaire compared to women in the SW group. For maternal age, income and marital status there were no differences found.

Through statistical analysis the different feeding styles used by mothers in this study were examined further. Using the answers of the CFQ the two groups of participants were compared for levels of restriction, pressure to eat, monitoring, perceived responsibility, concern for child weight and perceived parental weight. It was noticeable that mothers in the BLW group showed significantly lower levels of restriction, pressure to eat and monitoring compared to the SW group, while they also, independently of infant birth or current weight, reported significantly lower levels of concern for their child's weight. Conversely, for perceived parental weight and perceived maternal responsibility there were no differences found.

While the reported birth weights ranged from 2.75 to 5.25 kg with a mean weight of 3,58 kg, the approximate weight at six months ranged from 5.8 to 10.6 kg with a mean weight of 7.45 kg and the current weight when filling in the questionnaire ranged from 7.2 to 13.8 kg with a mean weight of 10.45 kg. Generally a high infant weight at six months was associated with increased levels of parental restriction and lower pressure to eat. A perceived infant size above average at six months also lowered the odds of pressure to eat being applied by the parents, as well as the level of monitoring and concern for child weight. While there was no difference found between the BLW and SW group for infant weight or perceived size.

The findings of this study suggest that mothers following BLW apply lower levels of maternal control and therefore allow their infant to self-regulate their food intake a lot more compared to parents using a standard approach. That potentially gives infants who are weaned with a BLW approach the opportunity to develop positive eating behaviours and weight gaining patterns in the future due to the low level of maternal control that is exerted. The authors emphasize that further research is needed to testify the influence of maternal control during the weaning period in the long term and whether the choice of feeding style has an impact on child eating behaviour and child weight in the future.

As this study was cross-sectional, it cannot be determined whether following BLW causes lower levels of maternal control or if mothers who tend to be less controlling choose to follow a BLW approach to weaning. On the other hand infant characteristics like slow weight gain or health problems could cause parents to choose SW over BLW. It cannot yet be securely stated that BLW has a positive effect on children's eating behaviour and weight or whether maternal characteristics, attitudes and concerns influence their choice of weaning methods. These possible relationships would be needed to be explored in a longitudinal study. Also it would be important to examine if a low level of maternal control is truly beneficial for the child or if they maybe need to be encouraged to eat solid foods when these are first introduced.

As with their preceding study the authors explain that in this study the sample of participants had a level of education higher than average. This might be due to information about BLW not being transferred by though mainstream sources. Furthermore the selection of participants was online based, a method that is criticized for attracting white, middle class, older and more educated women, which could also be a reason for the above average education of this study's participants. The authors therefore suggest the examination of the use and occurrence of BLW in a population based sample to verify their findings. Finally, Brown and Lee conclude that their study suggests that mothers following a baby-led weaning approach, compared to mothers using standard weaning, exert lower levels of maternal control, which may have positive consequences for future child feeding, child weight and child eating behaviour.

2.2.3 2012

In 2012, Townsend and Pitchford aimed to examine the influence of the chosen feeding style on food preferences and health-related outcomes like the Body-Mass-Index (BMI) in a case-controlled sample **(Townsend & Pitchford, 2012)**.
For this purpose parents of 155 children aged between 20 and 78 months were recruited using advertisement on relevant internet sites as well as from the database of Nottingham Toddler laboratory. The participants subsequently completed a questionnaire including questions about infant feeding and weaning style, their baby's preference for 151 foods sorted into standard food categories (like carbohydrates, dairy, proteins etc. including a category for whole meals) rated from 1 ("loves it") to 5 ("hates it"), exposure to different foods from 1 ("more than once a day" to 7 ("less than once per month") and picky eating (requiring a yes/no response). The questionnaire additionally included child height and weight in order to calculate the infants' BMI. The different weaning groups were formed using self-definition by the parents as there is no formal definition existing for BLW. However, parents who self-identified as users of BLW were asked some specific questions about the method to verify their predominant use of finger foods alongside fulfilling other typical criteria for the BLW method. The division into the two groups resulted in 92 participants in the baby-led group and 63 participants in the spoon-fed group. Collected data was then statistically analysed and compared between the two groups resulting in the following outcomes: The baby-led group showed increased preference for all food categories except sweets when compared to the spoon-fed group, although after analysis this was only found to be significant for the food category of carbohydrates. For the baby-led group

carbohydrates were also the most preferred foods although the exposure to carbohydrates in the spoon-fed group was significantly higher, while the most preferred foods in the spoon-fed group were sweets. There was no association found between food preferences and exposure to certain foods and socially desirable responding or socioeconomic status (SES), except an increased liking for vegetables being related to higher social status.

While there was a higher occurrence of underweight children in the baby-led group (3/63) there was also an increased incidence of obesity in the spoon-fed group (8/63), although it should be noted that 32% of the data on BMI was missing in the baby-led group. There was no difference found in picky eating between the two groups. Interestingly, 93,5% of the BLW users in this study reported that they had never experienced a choking incident while using BLW on their children, although choking is one of the most commonly expressed concerns for parents and healthcare professionals.

The authors of the study conclude from these results that the weaning style has an influence on food preferences and health in early childhood. It appears that using a BLW approach promotes a lower BMI and a preference for healthy foods like carbohydrates, which play an important role in a wholesome nutrition. The authors emphasize that these findings have implications for the fight against obesity in our modern western society, although the study design raises some limitations. First of all the study's results are based on self-report which, although being standard procedure when assessing food preferences is vulnerable for errors. However, the results of the study were controlled for self-presentation effects and none were found. Another limitation is presented by the rather small sample size. The authors therefore suggest a large controlled prospective study to verify the results as well as examine further coherences between the weaning practices and other key factors during infancy (e.g. BMI, milk feeding practice, SES etc.).

Moreover, in 2012 an online survey was conducted in an effort to assess the knowledge of the weaning guidelines in a sample of parents from the UK and explore the influence their understanding of the guidelines had on their timing of weaning compared to other influencing factors **(Moore et al., 2014,** first published online 2012**)**. Especially the factors that lead to early weaning opposed to factors that predict weaning in accordance to the guidelines (around six months) were examined in this context.

The survey was implemented via online questionnaire and included 21 questions with multiple choice, "yes/no" and Likert scale responses. Aside from collecting basic demographic data, the questions were divided into themed sections concerning the age of weaning of the most recent

child, understanding of the current weaning guidelines, factors influencing the timing of weaning, sources of information about when to wean, antenatal care, feeding choices during the first six months and feelings about the weaning process.

After excluding participants who were not UK residents and who had a baby but not yet weaned, there were a total of 3607 eligible participants who completed the survey. 99% of the respondents were female and 46% were having their first child, while 35% had a child under one year and 57% had a child of one to three years. All participants had weaned a baby since the introduction of the latest guideline and 16% had also weaned another child before the weaning guidelines changed in 2003. 13% of the babies in this study were weaned before 17 weeks, 37% were weaned at 18-23 weeks, 25% at 24-25 weeks and 25% at 26 weeks (mean age of weaning was 23 weeks).

Of the 3607 eligible parents 86% accurately understood the weaning guidelines to start weaning around six months. While the knowledge and understanding of the guidelines was associated with later weaning independently of demographic factors, it did not ensure compliance, as 80% of mothers who introduced solid foods before 24 weeks and 65% who weaned before 17 weeks knew that the guidelines recommended a later introduction. Parents who were receiving benefits, had short education (education to 16) and members of minority ethnic groups had poorer understanding of the guidelines. At the same time a poor understanding of the weaning guidelines was the most reliable predictor of an early introduction of solid foods, along with young maternal age, while following a baby-led weaning approach was the most reliable predictor for weaning at the recommended 26 weeks of age, along with reliance on advice from the internet.

The authors of the study acknowledge that the survey has not necessarily recruited a nationally representative sample, as most participants were principally highly educated, affluent, white English mothers. However, as it was a large sample other social and ethnic groups could be identified and significantly linked to certain results.

Furthermore, there was a cross-sectional pilot study published in the year 2012 as well to determine whether parents following a BLW approach have changes occurring in their own diet during weaning and explore if their babies were offered family foods **(Rowan & Harris, 2012)**. The authors emphasize that, while at the time the study was conducted there was already research existing to explore the theories behind BLW and the characteristics of parents who use

this method, this pilot study was the first to investigate whether using a BLW approach would influence the dietary intake of the parents and if the children were indeed offered family foods.

The participants were recruited via website advertisement and were chosen if they fulfilled the following criteria: having a child approaching six months of age, being the baby's primary caregiver, planning to use the BLW method as defined by Rapley and having read her book ''Baby-Led Weaning: Helping Your Child Love Good Food'' (Rapley & Murkett, 2008). Parents of infants born before 37 weeks of gestation or showing developmental delays were excluded, as well as households with more than one child (as an older sibling could have an effect on the offering of family foods) and parents with a family history of food allergies.

Two cross-sectional surveys were used to report the dietary intake of the participating parents, one before (baseline) and one three months after the first introduction of solid foods. The dietary intake was documented in 3-day diet diaries sent to the parents and returned via e-mail. In order to determine whether the infant was being offered the same foods as the rest of the family, parents also kept record of all the foods they offered their child, even though these were not necessarily consumed. The records were then compared to assess whether the foods offered to the child were the same that were currently being consumed by the participating parent.

Of the 25 respondents to the online request 16 were eligible for the study and eleven of them agreed to participate by signing a consent form. Those being eligible but not giving their consent were mainly put off by the effort of having to complete the 3-day diet diaries two times. Of the eleven consenting parents ten completely filled out the two 3-day diet diaries, which were then analysed for caloric intake, saturated and trans-fats, sodium, sugars, vitamin C, folate and fibre. All participants were female and introducing solids via BLW method. Their age range was 29-35 years with a mean age of 32 years. Six participating mothers were UK residents, while four of them were from the United States. When the first collection of dietary data took place, all participants were breastfeeding, their infants being five to six months of age at the time. Nine out of ten mothers were still breastfeeding when the second diet diary collection took place three months later.

After statistical analysis of the collected data it was found that no significant changes in the parents' diet took place during the first three months of weaning. Of the foods offered to the baby 57% were the same foods that the mother was currently consuming, while 85% of the time child and parent were eating together. These results suggest that using the BLW method does not lead to dietary changes among parents when first introducing solids to their children. This

could represent a problem, as the dietary analysis in this study revealed that the participating mothers' intake of some key nutrients did not match the current recommendations in the U.S. or UK. While the intake of saturated fat and sodium of the women in the study was too high, which could be harmful to the cardiovascular system (Nishida & Uauy, 2009), the sugar intake exceeded the UK recommendation of 11% of food energy (Pheasant, 2008). Furthermore, the overall energy intake of the mothers was too low, as was the intake of folate. These results were obtained by examining food and beverage intake only though, any intake of nutrient supplements was not considered.
While this study is hardly representative because of a very small sample, the findings suggest a certain necessity to conduct further research concerning the dietary intake of both followers of the BLW method and their infants.

Finally, a study was conducted to examine the knowledge of, attitudes to and experiences with BLW of both mothers and healthcare professionals (HP) **(Cameron, Heath, & Taylor, 2012)**. 31 healthcare professionals and 20 mothers who had used a BLW approach were questioned about BLW using a semi-structured interview. Mothers could participate in the study if they said to have used BLW, so BLW was self-defined, while the healthcare professionals were all working with infants and families. The recruiting took place via word of mouth, newspaper advertising and e-mail snowballing. The parenting groups that were contacted during the recruiting were not specified on BLW, although BLW was an addressed topic during the parenting program. The healthcare professionals were recruited via clinical establishments and institutions. The interviews took place either at home (mothers) or at work (HPs).
The interview schedule was developed with help of the currently existing literature about BLW and the knowledge of the authors. A brief description of BLW was given if an interviewed HP did not know about this method. The interview had a structured first part with general questions (different for mothers and healthcare professionals) and an unstructured second part to allow individual questioning.
Nearly half of the participating HPs had heard of BLW, mostly from friends and family rather than from patients. The main aspect known to them was that children following BLW are feeding themselves whole foods instead of being spoon-fed purées, little other aspects were discussed during the interviews. All HPs thought that BLW could be beneficial for the family and the child, with the main advantage being shared family meals, which are known for nutritional and psychological benefits. Some also supposed that mealtime battles would be less likely, because

BLW allows the child to be in control of what and how much they want to eat and because BLW presents an alternative feeding method if the child refuses to be spoon-fed. Furthermore, most HPs assumed following a baby-led approach would encourage healthier dietary behaviours by letting the child explore a wide variety of foods. They also took into consideration that BLW would encourage better hunger-satiation-regulation in children, because mothers were less likely to control the amount of food eaten and they saw the analogy between BLW and breastfeeding on demand. Some of the participating HPs who have children themselves could imagine BLW being more convenient for everyday life than the use of purées. They also suggested BLW might have developmental advantages, like better oral and chewing skills and enhanced fine motor skills. Despite these perceived positive aspects, healthcare professionals also reported some major concerns about the BLW method. One of the most often perceived risks when following a BLW approach was choking and that was also the main reason why HPs felt reluctant to recommend BLW, especially when the HP had no personal experience with the method. They were worried about mothers leaving their child alone with the food (although BLW as described by Rapley does explicitly tell parents not to (Rapley & Murkett, 2008)), as well as mothers maybe becoming competitive about their child's progress and therefore increasing the choking risk by giving unsafe foods ("Oh look, she's eating raw carrot at age six months!"). Apart from choking, HPs were concerned with the potential risk of growth faltering caused by an insufficient energy intake, being caused by first foods being low in energy and clumsy self-feeding, as well as with the risk of poor iron status as the BLW method would lead to not giving iron fortified cereal as one of the first foods. They were also worried that some mothers might give their children highly processed foods like cereal bars and chocolate biscuits (although BLW does not encourage that (Rapley & Murkett, 2008)). Some also thought BLW might encourage parental anxiety as the mothers would have to see the struggling and difficulties a child would have with the first attempts of self-feeding and finally some HPs supposed BLW would probably be very messy and a lot of food would be wasted.

The interviews with the mothers participating in this study led to entirely different results. Firstly, most mothers (18/20) started BLW when their child was 5.5-6 months old, while all mothers had exclusively breastfed their infants before starting solids. Although BLW encourages parents to start complementary feeding when the child shows certain signs, only two mothers in the study started solids when their children reached out for food. All other participants started the introduction of solids on advice of their HP or because of following WHO guidelines. The most commonly reported first foods introduced to the babies were fruit and vegetables, while most

mothers reported that the child shared every meal with at least one family member. To some extend many mothers also used some spoon-feeding, but not on a regular basis. Reasons reported for the use spoon-feeding were unusual circumstances (like when the child was sick), avoiding a mess or increasing iron or energy intake. The majority of mothers in the study defined BLW as offering suitable finger-foods, letting the child decide what and how much to eat and not spoon-feeding purées. This information they had about BLW mainly came from the internet. There were different reasons why mothers decided to try BLW being because it made sense to them, seemed logical, seemed less time consuming, more convenient or less expensive than traditional weaning.

Compared to healthcare professionals, the participating mothers were generally not concerned about choking. Nearly all mothers (19/20) reported at least one incident of gagging, but they were not concerned about that, because they knew the difference between gagging and choking. However, 30% reported at least one episode of choking, most commonly on raw apple, but infants were able to remove the food by coughing and no first aid was needed.

There were many positive opinions stated about the BLW method. Mothers reported that as the baby eats the same foods as the family there is less meal preparation involved and in addition to this parents can eat their meal at the same time the baby eats theirs. Some of the mothers liked that BLW has no detailed step-by-step weaning protocol but instead encourages parents to respond to their infants needs and that the fewer rules of BLW make the transition to solids easier and less frightening for parents. Participating mothers believed that BLW might help their children to develop healthy eating behaviours like eating until being full, sharing meals with the family and eating a wide variety of foods. Most mothers (15/20) had no concerns at all about BLW and all participating mothers would recommend BLW to others, while two of them would use some additional spoon-feeding to make sure the child gets all the nutrients.

There were also some negative aspects mentioned by the mothers in the study. Some of them worried about the appropriateness of certain foods and did not know which foods were suitable for what age (which is an indicator for comprehensive guidelines for BLW being needed). One mother was concerned about her babies iron intake and therefore spoon-fed the infant iron-fortified cereal in addition to the self-feeding of finger-foods.

Finally, many mothers reported the mess at mealtimes being the main disadvantage of BLW, but they also indicated that as the motor skills developed and their children became accustomed to feeding themselves the mess significantly decreased. Furthermore, mothers who had tried both BLW and TW emphasized that both methods were messy, thus not being a problem exclusive to

BLW.

The authors conclude that, given the lack of existing research, further scientific work is needed about BLW to determine whether the perceived advantages and disadvantages, that are very different between mothers and healthcare professionals, are effective and valid. The results of the study show a high deviation between mothers' and healthcare professionals' knowledge of, attitudes to and experiences with BLW. The authors suggest the implementation of further research about BLW especially targeting the method's influence on future eating behaviours as well as its safety and nutrient and energy sufficiency.

Regarding the limitations of the study it is paramount to mention that the sample was self-selected, which could have influenced the results (i.e. parents with concerns for choking or low energy or iron intake may have chosen not to follow BLW, being the reason for mothers in the study not being concerned). Furthermore, the sample-size was small. The authors emphasize that the study is of qualitative nature and not meant to be representative for the whole population.

2.2.4 2013

In 2013, another study by Cameron and her colleagues aimed to compare the feeding practices and certain health-related behaviours between NZ families following a baby-led or a traditional parent-led introduction to solid foods **(Cameron, Taylor & Heath, 2013)**.

The 199 participants of the study were recruited from the four urban centres Auckland, Wellington, Christchurch and Dunedin via newspaper advertisement which did only mention introduction to complementary foods, but not the term BLW itself. An inclusion criterion was having a healthy child between 6 and 12 months of age. The survey was conducted via online questionnaire and was divided into four main parts: 1. Starting complementary foods, 2. BLW, 3. Attitudes towards, and experiences of feeding the infant, 4. Demographic information.

In order to compare the results of the survey the participants were subsequently administered into four groups. Parents who reported that they had tried BLW and whose infant always or at least mostly fed themselves at six to seven months were identified as "adherent BLW", while parents who reported having tried BLW but were still spoon-feeding their infant half of the time where identified as "self-identified BLW". The remaining participants who did not report to have tried BLW were classified as either "parent-led feeding" if they reported spoon-feeding their infant more than 50% of the time or as "unclassified method" if they reported their infant

feeding themselves most of the time or always at six to seven months, but did not identify themselves as following BLW.

After statistical analysis of the data it was found that 140 participants belonged to the “parent-led feeding” group, while 42 were found to be “self-identified BLW”, 17 followed “adherent BLW” and 0 used an unclassified method. All participants in this study were mothers, half of them were 30-39 years old, 55% had more than one child and 66% of them had a tertiary qualification. The mean age of the children was 8.6 months. At the same time maternal age and what NZ region the mothers came from was found to be linked to the feeding method of choice, i.e. mothers between 20 and 29 years of age were more likely to be following self-identified BLW and mothers from Christchurch were more likely to follow adherent BLW than those coming from Auckland. No other significant differences in participant characteristics were associated with differences in feeding methods though.

Only a small number of participants (8%) were identified as adherent BLW. Significantly more participants (21%) who reported following BLW were more flexible in their feeding practices which included a combination of self-feeding and spoon-feeding. This generally took place if the infant could not feed itself, e.g. because of being sick, or to ensure a certain nutrient intake like iron by feeding iron-fortified cereal or similar. This parental practice suggests that spoon-feeding and self-feeding aren’t necessarily opposing each other but can be combined to suit the needs of the child.

58% of the infants in the study were exclusively breastfed until they were five months old and only 4% of the participants reported they never exclusively breastfed. Still, 63% of the children in the study received their first solid foods before the recommended age of six months. Among the identified groups 53% of the mothers from the “adherent BLW” exclusively breastfed until six months of age as is recommended by the WHO (World Health Organization, 2002), while only 28% of the “self-identified BLW” and 21% of the “parent-led feeding” group met this recommendation. At the same time 65% of the participants in the “adherent BLW” group introduced complementary foods at the recommended six months of age and not before, alongside only 33% of the parents in the “self-identified BLW” and 34% in the “Parent-led feeding” group.

The authors claim to have found important relationships between the chosen method of feeding and the likelihood of meeting the WHO recommendations (World Health Organization, 2002). They found that the “adherent BLW” group was more likely to exclusively breastfeed for six months as well as introducing complementary foods at six months of age. Infants from the

“adherent BLW” group were also more likely to being offered the same foods their family members had and less likely to receive commercially prepared baby food, although both BLW groups were more likely to share all or most of their meals with the family compared to the “parent-led feeding” group.

The use of iron-fortified cereal as one of the first food did occur in “self-identified BLW” as well as “parent-led feeding” but not in the “adherent BLW” group. As the “adherent BLW” group was most likely to offer fruit and vegetables as first foods, which are generally low in iron, the risk of a suboptimal iron status might be increased, as infants should also receive iron-rich foods such as meat, meat alternatives or iron-fortified foods as soon as solid foods are introduced (Anderson & McLaren, 2009) (Domellöf, 2011). However, neither was iron intake measured nor was determined how long only fruit and vegetables were offered by parents in this study and at what age iron-rich foods were introduced by parents who were not using iron-fortified baby cereal. On the other hand as infants on the BLW method receive family foods more often they have a greater potential for a wider variety of iron-rich foods, e.g. if pieces of cooked red meat are offered. The bioavailability of iron from these foods is much higher (15.5%) than from infant cereals (3%) (Dube et al., 2010). However, biochemical iron status was not determined in the study either, so no conclusions can be made about the iron statuses among different feeding groups.

There was no difference found between different feeding styles concerning the risk of choking, though more than 30% of the participants reported at least one episode of choking, which most commonly involved whole foods. However, as parents often find it difficult to distinguish about choking and gagging, it is possible that some participants mistook gagging for choking.

Knowledge about BLW was also part of the survey. It was found that 38% of the participants had never before heard of BLW, while 7,6% reported knowing the method well and 54,1% reported knowing something or little about it. Parents in this study had most commonly heard about BLW through friends and family rather than from a healthcare professional. Of those who had tried BLW all reported that they would recommend the method, although more than half would even more happily recommend a mixed approach of BLW combined with some spoon-feeding. Almost half of the parents from the “parent-led feeding” group were willing to try BLW if they had another child. Adding up the parents willing to try BLW and those who reported already using a baby-led approach results in 79% of the participants being willing to adopt the BLW method at least to some extent, even though many participants of the study had never heard of BLW before. Those who would not be willing to try BLW reported the fear of choking, concern about their

infant not eating enough, doubts about the infants ability to self-feed and “parent-led feeding” had worked fine for them as their primary reasons.

This study describes BLW and parent-led weaning in a general population opposed to other studies who recruited their participants from BLW-groups or websites. By advertising the study in public domains (newspaper) the authors aimed to improve the representativeness of the sample. However, the survey was conducted via internet, meaning only persons with internet access could enter. Recent data showing 86% of NZ families having a private internet access suggest most New Zealanders would be able to take part in web based studies (Bell et al., 2010). Still, as the newspaper advertisement was displayed in urban areas, the sample could be unrepresentative for rural NZ population. Furthermore participants of the study have been shown to be educated above NZ average.

It was found that the extent to which families followed BLW influenced the association between infant feeding method and health-related behaviours, which indicates that for health care professionals as well as for researchers the extent of the infant feeding itself is important when parents report following BLW. Although the authors observed significant associations between the feeding methods when solid foods were introduced for the first time and health related outcomes, due to the cross-sectional study design the direction of these associations cannot be ascertained. The authors emphasize the importance of prospective studies as well as randomized controlled trials to confirm the results of their study.

Another study about baby-led weaning was published also in 2013, but based in the UK, exploring the attitudes, beliefs and behaviours of mothers following a BLW approach **(Brown & Lee, 2013)**. In this entirely qualitative study 36 mothers of an infant aged 12-18 months who were following a BLW approach were interviewed about key themes surrounding BLW including recognizing infant cues of readiness, hunger and satiety, exposure to different textures and tastes as well as both positive and negative experiences with the method.

As BLW is not yet commonly present among the mainstream population the participants for this study were specifically targeted and recruited via online advertisement in a baby-led weaning forum as well as snowballing. This might have led to an elite self-selecting sample within the users of BLW but these limitations were recognised in this study that is not trying to be representative. As in their previous studies Brown and Lee identified parents as following BLW if they had used both spoon-feeding and purées 10% of the time or less. Infants that had low birthweight were born prematurely or had any significant health conditions were excluded from

the study.

The 36 participating mothers were interviewed by a researcher using a semi-structured interview, the answers were recorded using Dictaphone and then transcribed for data analysis. While the mean age of participants was 28.6 (standard deviation (SD): 5,62) the mean years of education they had was 14,27 (SD: 2,33).

The interview included a range of different questions about the mothers' attitude, beliefs and experiences around using the BLW method. First of all the timing of introduction of complementary foods in this sample was closely connected to the concept of developmental readiness of the child. The mean age when solid foods were first introduced was 25.08 weeks, ranging from 22-32 weeks. All mothers in the study were aware of the relevant recommendations to introduce complementary foods at six months of age and used this for orientation, although they also reported observing their infant for developmental signs of being ready for solids like being able to sit up without support, grasp things with their hands and bring them to their mouth. It was often reported during the interviews that the infant simply took food from the mother and started to mouth or even eat it, which was logically taken as a sign of readiness. Along with the introduction of solid foods all infants in the study were continually milk fed, generally on demand, meaning the child decides amount and frequency of milk consumption. The majority of women in the study were breastfeeding their children.

Instead of being spoon-fed infants in this study were able to choose and eat food by themselves while they were eating the same meals as the family, sometimes adjusted in form and shape for easier handling. In this study all mothers reported their children taking part in family mealtimes or ate at the same time with at least one other family member. Some also reported adapting the timing of those shared meals to suit the infants hunger pattern.

As the diet of an adult may not be entirely suitable for a baby because of higher levels of salt, sugar and additives, mothers in this study reported adapting family meals to suit the infant as well as ensuring to be offering a wide variety and a balanced diet. Herbs and spices and different flavoured foods were still used freely though and willingly accepted by the infants. A popular belief among study participants was that following BLW would lead to the child accepting and eating a wide variety of different foods, being less fussy than spoon-fed children as well as adapting a healthy relationship to food and a healthy diet for the future.

The interview schedule also included questions about maternal need for control during the feeding process. In this sample most mothers described a feeding style that was low in control, but then many of them reported that one of the reasons they chose to follow BLW was that the

infant themselves would be in control what and how much they eat. Many participants reported that the amount their baby ate varied greatly but was balanced out by an adjusting milk intake. It was another popular belief that allowing the infant to be in control of what and how much they eat would encourage better self-regulation in later life leading to a normal weight and healthy eating behaviour. Some mothers also reported incidentally having concerns but getting more and more relaxed about their child's food intake along the way when seeing that they infant was healthy and gaining weight. At the same time mothers did discuss awareness towards the variety of nutrients their child was getting from the food consumed, meaning they did take care to offer foods low in salt and sugar and offer lots of healthy, nutrient dense foods at the same time, so the baby would be able to pick the foods that suited their needs. Overall mothers in this study reported being relaxed and trusting their children to make the right food choices.

Another key theme on the interview was how parents came to choose BLW and what experiences they made with the method. The most common reason given by mothers in this study as to why they chose BLW was because "it made sense to them", regarding it to be the most natural and enjoyable way to introduce solid foods to their baby. After having tried it most mothers considered BLW to be a simple, convenient way to wean their children while this method easily fitted with the family lifestyle and mealtimes. Mealtimes were perceived as easy, more enjoyable and less stressful because parents and children could eat at the same time and no feeding by the parent was required. Mothers also thought the experience of eating whole foods would be more enjoyable and more natural for their infant than being spoon-fed purées. Besides parents did not have to follow a certain plan for introducing complementary foods, e.g. starting with semi-liquids and slowly transitioning to lumpier textures, this led to an overall experience that was perceived to be simple for all involved parties. However, using BLW also presented mothers with some challenges. One of them was the mess that was created during mealtimes, especially in the early months of weaning when the infant was still more experimenting with the food than eating much. The participants in this study reported that it was possible to adapt to this, e.g. by covering the floor underneath the high chair, and that the mess lessened as the infant got more skilled in self-feeding. A problem related to mess was that food would be wasted when children drop foods or decided not to eat them. But as with the mess, the amount of food being wasted also diminished over time, especially when the children ate the same foods and meals the family had, which was seen as convenient and cost-effective.

A very common concern about BLW is that the infant might be at a higher risk of choking, although this could not be scientifically shown yet. Many mothers in this study were also

concerned about choking in the beginning but, as with the need for control, mothers became more relaxed over time and learned to distinguish between gagging and choking. In hindsight they reported not to feel as if their children had been at greater risk of choking.
Overall the mothers in this sample, who all successfully weaned their children using the BLW approach, described this method as a simple and uncomplicated method if one is willing to overcome the challenges of it.
The authors emphasize that it cannot be determined whether the positive behaviours and choices of mothers, e.g. introducing complementary foods according to the guidelines at six months of age, in this study were related to the method of BLW or if the self-selecting, well-educated sample was the cause of these findings. Mothers in this study did explicitly report themselves feeling that following BLW had improved their choices and lessened their need for control over the infant's food intake, as well as improving the family diet, though. The authors also discuss the risk of BLW being misused by parents giving unsuitable foods to their children or neglecting their duty of supervision during meals, although this has not been observed in any way so far. Furthermore it is not clear if positive health outcomes, if they occur subsequently to using BLW, are caused by the key factors of self-feeding and avoidance of purées or if maybe factors like low maternal control and food choices have a greater impact on the outcome. Finally, they conclude that mothers in this study made an overall positive experience with using BLW and that the contents of the interviews could be helpful for those working with weaning parents. This qualitative study gives important insight into the BLW approach that could be useful for healthcare professionals wanting to support parents with this method. Clearly the self-selecting sample is not representative for the general population, but the study shows how BLW can work and what attitudes and beliefs stand behind it.

2.2.5 2014

A study in 2014 that was also based in the UK aimed to examine the reported experiences of mothers and their children using the BLW method as well **(Arden & Abbott, 2014)**. Again, the study intended to explore the underlying beliefs and attitudes of the mothers and help to understand the benefits and challenges of BLW better and allow important insights into the method.
The participants for the study were searched through the internet on parenting sites and forums in the UK. The recruitment took place through forums with a focus on BLW as well as general

parenting sites to get a wide range of different experiences. Including criteria were that the respondents had tried BLW (even if it was mixed with other methods or if they changed their approach along the way), had an infant between 9 and 15 months and were residents of the UK. The study consisted of an interviewing process via e-mail. Of the 27 initial respondents, 25 started to take part in the interviews, with a final of 15 women having completed the interview process. The interview itself was semi-structured and took place over a course of five e-mails, in which the researchers sent questions to the participants, whose answers were then followed by more questions to specify the content of their response.

After analysis of the data the four main themes were found being “trusting the child”, “parental control and responsibility”, “precious milk” and “renegotiating BLW”. Each of these also contained several sub-themes.

The first main theme “trusting the child” also contained the issue whether food served the purpose of satisfying a feeling of hunger or if it was rather seen as a thing to play with for the infants. Parents reported that at first food was used merely as a toy and that it took quite some time until their baby started to eat the food on the purpose of satiety. This transition seemed to be related to the mother’s ability to trust their child to know the right time for their weaning and the mother’s belief that the ingestion of solids is not absolutely necessary until the age of one year. Which is much later that what the WHO recommends but carried through the BLW approach as it was understood in this study by the phrase “food until one is just for fun”. Some parents reported that their children were interested in solid foods before the recommended time of introduction of six month and so the introduction took place earlier. Not because the parents offered the food this early, but because the infant “stole” it, i.e. grabbed and ate it without the parents’ intention. Despite the risks of an early introduction of solids, i.e. not readily developed motor and oral skills of the child, choking risk etc., this tended to worry parents less than when the babies’ intake of solid foods was delayed. The transition from playing with food to using food for sustenance was coherent with trusting the child to develop the necessary skills for self-feeding at the same pace as its nutritional needs. Some parents even reported the food motivated their child to develop their skills and although the infant was not eating very much, the baby gradually learned to eat and handle food.

Another sub-theme focused on the infant having control of the amount of food that was being eaten by either indicating the desire for more food or stopping the eating process by themselves. Parents reported their children being a good “judge” of how much food they needed. This is consistent with one of the principles of BLW which says that a baby, just like when its being

breastfed, keeps a natural and healthy hunger-satiation-regulation. Some parents also reported their children knowing what type of food they needed and purposely choosing that part of the meal.

Naturally, parents wished for their children to develop a healthy appetite control and the ability to make healthy food choices. During the weaning period participants of the study trusted their children to eat the right amount and make the right choices (out of the healthy foods offered) for themselves. This subtheme of “trusting the child” was called “idealized eating” in the course of the study. Related to this, some parents hoped that the idealized eating abilities would last for the babies’ whole lives and therefore form the foundation for lasting healthy eating habits. Overall the participants trusted their infants ability to know how much and what they needed to eat and that they would develop the necessary skills for self-feeding at the right time.

The second main theme “parental control and responsibility” clearly contrasts the first main theme about “trusting the child”. Some parents reported the desire to monitor the amount and types of food being eaten, what is very difficult on BLW. It is hard to measure the actual amount of food being eaten and the consumed portions vary a lot between days. But there was also one parent who consciously chose a BLW approach to ensure they would not be overly monitoring about their child’s consumption. The participant thought that on a traditional weaning approach she would be tempted to measure too many things and that would not be healthy neither for herself nor the child, therefore choosing the BLW approach deliberately because it tends to be low in control. Some parents reported monitoring their infant’s food intake through indirect methods by checking nappy contents and weight gain or other factors like better sleep.

Among the participants there were some parents who chose BLW because their attempts of a traditional way of weaning had failed, e.g. because their children refused to be spoon fed. They reported their baby also having refused solid foods when their parents first introduced them on the BLW approach, but this refusal was “allowed” by the feeding approach and did not further worry the parents as BLW suggests that the infant is starting to eat once it is ready.

Another subtheme to “parental control and responsibility” was the provision of a balanced nutrition. Parents did control the type of food their children ate by choosing the type of foods they would be exposed to. This meant offering a range of healthy foods and withholding treats or foods that where perceived as unhealthy. The participants reported that family meals were adapted for appropriateness and sometimes additional foods where offered especially for the infant. Parents said they were trying to offer their children all the nutrients they needed in the foods they displayed to them, although they could not measure if they really ate a balanced diet.

However, BLW does encourage the parents to trust their children with choosing the foods according to their needs, as long as healthy and nutritious foods are being offered to them in a wide variety.

While Brown & Lee (2011a) found that parents following a BLW approach were less anxious then those who followed traditional weaning, some parents on this study had major concerns about the amount of food their baby ate and the intake of all necessary nutrients. Some parents focused more on the positive aspects though, like eating as a family and enjoying this instead of worrying about the amount eaten.

However, parents on the study spoke against forcing their children to do things they are not ready for, which includes eating solids. They also stated while they saw other people's babies screaming at the table, that they were having fun at mealtimes with the BLW method.

Participants reported other people they knew spoon feeding their children in a hurry, deceiving them to eat more by alternating different tastes and how they felt uncomfortable about these circumstances.

Generally, participants placed great emphasis on their desire to find the best weaning practice for their child and most often BLW aligned with that. There was also a special focus on the recommendation to fully breastfeed the baby until six month, i.e. 26 weeks. This also included ignoring a health professional's advice if it entailed feeding the baby solids before six month. E.g. one mother was told by her child's doctor to give her infant baby rice at only five month, because her baby was a "big girl". The determination to not introduce solids before six month and the theme of trusting the child to know when they need to have solid foods represents an inherent conflict for participants of the study. On the other hand, if solids were introduced before six month, the trusting of the child was used to validate the choices made.

Overall, although a main aspect of BLW is trusting the child to make the right choices, many parents obtained a level of control by determining the availability of certain foods at a certain time (i.e. only healthy foods and not before six month of age). This derived from their desire to follow the best practice possible for their baby. The participants of the study reported some concerns about the nutritional needs of their child being fulfilled, but on the contrary associated traditional weening with forced feeding.

Some of them followed a BLW approach after the attempt of TW failed, because BLW allowed a later introduction of solids and reduced their level of anxiety.

The third main theme called "precious milk" explored the importance of milk in the infant's nutrition. The majority of participants breastfed their babies and were convinced of the

importance of breastmilk during the process of the introduction of solids, particularly until the age of one. They reported that their children still got all nutrients and energy they needed though breastmilk and should not be rushed to eat solid foods. The WHO guidelines also promote breastfeeding until the age of two alongside feeding solids, but they do not agree with the assumption that breastfeeding is sufficient until the age of one (World Health Organization, 2003). The WHO states that the introduction of solid foods should not be delayed beyond 180 days. Some parents were worried that their baby would stop breastfeeding early as they wanted to obtain the closeness and feelings perceived while breastfeeding to continue longer. This also promoted the BLW approach to them rather than traditional weaning.

For some parents the BLW approach also seemed attractive because it fits their parenting style. Some participants mentioned attachment parenting, baby-wearing and co-sleeping in the context of breastfeeding and BLW.

The final main theme discussed in the study was called “renegotiating BLW” and addressed certain adjustments parents made to optimize the BLW method to suit their or the baby’s needs. Participants reported very different experiences with BLW. Many parents deviated from some key principles of BLW at times because of practical or other reasons, for example spoon feeding certain foods because of their consistency. They generally encouraged their infants to hold the spoon themselves though. Justification for spoon feeding was very often associated with the children making a mess. Parents also reported their children sometimes wanting food they could not pick up and eat by themselves yet so therefore they fed it to their babies when they made clear that they wanted it. Furthermore, the participants reported that the feeding practices at home differed from feeding practices at the nursery, mainly because they did not feel comfortable about asking the nursery to follow BLW, which can be seen as a cultural conflict. Generally parents tried to adjust BLW with the intention of using the best possible practice for their child. E.g. some parents stated that if a child did not like handling finger foods (yet) and preferred to be spoon-fed, that was still baby-led. For many parents in the study the introduction of solid foods was in fact a mixture of BLW and TW.

In summary, the study was able to reveal an insight into the experiences, beliefs and conflicts of BLW. Trusting the child to decide the right amount and type of food being eaten is a mayor characteristic of this weaning approach, a trust that also could be seen in the participants of the study. On the other hand parents also had a desire to have some control over the food their infants ate and avoid certain scenarios, which resulted in a process of renegotiating BLW. In conclusion, while some of the participants comments were consistent with the concept of BLW

by Gill Rapley (Rapley & Murkett, 2008), many experiences differed from it. There seem to be different reasons for parents deciding to follow a BLW approach. In this study, there were two main factors: parent philosophy or a failed try at TW. Further research is needed to clarify whether these two groups are representative and whether they make different experiences on BLW. It also needs to be investigated if a delayed ingestion of solids, which may take place while following BLW, has nutritional effects for the infant and to what extent. Furthermore some guidance by healthcare professionals for parents following a BLW approach would be helpful. Finally the authors explain that there are some potential limitations to this study. As the sample was self-selecting, participants in this study may have been persons with particularly strong views and opinions about BLW, while at the same time the recruiting via internet forums tends to be associated with reaching educated middle class rather than collecting a representative sample (Im & Chee, 2006). However, the use of online forums is also associated with mothers who choose to follow BLW (Brown & Lee, 2011a). The relatively high dropout rate during the interview sessions (10 out of 25), which are a common limitation to interviewing via e-mail (Meho, 2006), may have led to a further self-selection and certain tendencies throughout the sample. However, the authors of the study think that the experiences of the participants in the study cover a wide range and can therefore provide some important insights into the BLW method.

2.2.6 2015

In 2015 a study by Brown specifically explored the characteristics of mothers using a BLW approach compared to those who choose to wean traditionally **(Brown, 2015)**. Many of the previous studies that explored the impacts of the BLW method, mostly concentrating on the eating behaviour of the child as an outcome, had self-selected samples of participants. The aim of this study was to examine the differences in maternal characteristics between followers of BLW and users of the traditional weaning approach and how these characteristics correlate with the adoption or the outcome of the feeding style.

For this purpose 604 mothers with an infant aged six to twelve months completed a self-report questionnaire. Mothers of infants with low birthweight, premature birth or serious health issues were excluded from the study. The participants were recruited via child care centres, mother and baby groups in South West Wales (UK) as well as via UK based online parenting platforms. Because BLW is not a common practice in the general population, there was also specific

advertisement posted on BLW groups and online forums in order to ensure finding enough followers of BLW to allow comparison with traditional weaners in the sample. Questionnaires could be sent in a letter or be completed online. The questionnaire included maternal demographic background information, background information on the infant, questions concerning the weaning style, maternal weight before pregnancy and at the time of the survey, as well as different established scientific questionnaires. These were the Dutch Eating Behaviour Questionnaire (DEBQ) (van Strien et al., 1986), the 10-item personality measure (TIPM) (Gosling, Rentfrow, & Swann, 2003) and the Brief Symptom Inventory (BSI) (Derogatis & Melisaratos, 1983).

After acquiring and analysing the data from the survey participants were classified into BLW or TW groups according to the amount of spoon-feeding and purées used. Participants were considered to follow a baby-led approach when they spoon-fed or used purées 10% or less of the time. By these measures 351 mothers (58,1%) were identified as baby-led and 253 (41,9%) as traditional weaners. The mean age of the participants at childbirth was 29,02 years and their mean duration of education was 14,24 years, while 68,8% of the mothers were primiparous. It was found that participants from the BLW group had significantly higher education and were more likely to pursue a managerial or professional occupation compared to the TW group. For maternal age, income or marital status no difference was found between the groups, though. At the same time there was no significant difference found for any parameters between participants that were recruited online or face to face.

While the mean age of introduction of complementary foods to the infant in the whole sample was 20,76 weeks, in the TW group it was only 18,51 weeks, but 23,97 in the BLW group, meaning that followers of BLW were significantly more likely to introduce solid foods later, which might be important as a total of 65,9% of all participants introduced complementary foods before the recommended six months of age and 22,3% even started before 17 weeks of age. Not only was a later introduction of solids associated with lower levels of maternal anxiety and obsessive-compulsive symptoms, but also with higher extraversion and conscientiousness in mothers, as well as lower levels of maternal restraint and emotional eating in both the BLW and the TW group. There was also a significant relationship found between maternal and infant weight and the timing of introduction of complementary foods. In this study, mothers who had a higher BMI at birth and current BMI and whose infant was heavier at birth introduced solid foods earlier than mothers with a lower BMI or an infant weighing less at birth. However, there was no difference found for maternal pre-pregnant or current BMI or infant birth or current weight between the

groups. Mothers from the BLW group did report lower levels of anxiety and had lower obsessive-compulsive disorder scores compared to the TW group, though, but higher scores on conscientiousness traits. Finally, mothers from the BLW group showed significantly lower levels of restraint compared to traditional weaning mothers.

Overall this study showed that mothers with lower levels of anxiety and restraint but higher levels of extraversion and conscientiousness were more likely to introduce complementary foods later and were also more likely to choose a BLW approach. On the other hand mothers who showed high levels of anxiety, introversion and restrained and emotional eating were more likely to introduce solid foods early. It is possible that these character traits make mothers more likely to choose a traditional weaning approach, as it is higher in maternal control than BLW. Understanding how maternal characteristics interact with feeding style is important, because if BLW was to be established as a way of promoting healthier eating and weight gain, certain character traits of the mothers might limit or modify the feasibility of the method or change the outcomes of its appliance.

Those maternal characteristics that seem to be linked to the timing of complementary foods are the same that are associated with BLW, which suggests that there is an underlying approach to both method and timing. Choosing a BLW approach does naturally delay the introduction to solid foods as infants need to develop the necessary motor skills first, which usually does not happen before six months of age (Naylor & Morrow, 2001). In this study the links found between maternal characteristics and the choice of weaning style were independent of the timing of introducing solids, though. The authors consider it likely that the level of maternal desire for control and monitoring are the main factors for both decisions and that this level of desire is determined by anxiety and insecurity about food intake in the mother. Indeed, these maternal characteristics have been shown to be associated with a shorter breastfeeding duration (A. Brown, 2014), as breastfeeding is always baby-led with mothers having very little control over the amount taken by the infant (Brown et al., 2011).

The data of the study suggests that mothers who choose to follow BLW as opposed to TW are basically a different population. This raises further questions about the mainstream feasibility of BLW if the approach should be confirmed to promote healthier eating as initial findings suggest (Townsend & Pitchford, 2012)(Brown & Lee, 2015) and becomes more widely available and supported. The authors do emphasize on the importance about more immediate research about the influences maternal eating behaviour, personality and well-being has on differences in child outcomes compared to the impact the actual weaning method has. It would be interesting to

explore how parents who show high levels of anxiety and control would cope with a BLW approach, they suggest. An official definition for BLW would be needed in the process of a possible appliance of the method to a wider population, though, as the different definitions of BLW are an imitating factor for comparing the outcomes of existing research about the method. Finally this study has some limitations as well. As in previous research, this study also had a self-selecting sample, which is reflected in the higher education and maternal age compared to the general population. Because of the specific recruitment from baby-led weaning groups and online forums there might be some potential bias in the study's results. The results of examining maternal personality and behaviours should also be treated with caution as it took place in the post-natal period, which is known to be a period of considerable change (Nelson, 2003) and which can enhance mood disorders (Cohen & Nonacs, 2007). However, this study allows useful insights into different backgrounds of mothers and the influence this background has on the choice of weaning style.

Another study by Brown and Lee published in 2015 examined the influence of the weaning style on child satiety responsiveness **(Brown & Lee, 2015)**. The aim of the self-report correlational study was to compare the eating styles of children that were weaned traditionally and children that were weaned using a baby-led weaning approach at 18-24 months. In fact, the study aimed at to different things: the previously described comparison and the exploration of the role of maternal control, breastfeeding duration and solid food introduction in the development of the children's eating behaviour. For this purpose 298 mothers completed a longitudinal self-report questionnaire on the subject. First the CFQ was completed (Birch et al., 2001) at 6-12 months of age which includes breastfeeding duration, timing of solid foods, weaning style (baby-led or standard) and maternal control. Then at 18-24 months a follow-up questionnaire was used to report child eating style (satiety responsiveness, food-responsiveness, fussiness, enjoyment of food) and child weight. While the food-responsiveness describes the desire of the child to eat in response to certain food stimuli no matter how hungry they are, the satiety responsiveness reflects the ability to regulate food intake according to hunger and stop eating when satiety is reached.

The study reports the results of phase two of a two-part study. In part one it could be shown that BLW was associated with lower levels of maternal control compared to mothers who followed a standard or traditional weaning approach (Brown & Lee, 2011b). The participants of the study were recruited via local mother-and-baby-groups in South West Wales (UK), as well as through

UK based parenting forums on the internet. All participants were from the UK and 95 % of them completed the questionnaires online.

During phase one of the two-part study, the participating parents were classified into BLW or SW depending on how many percent of the time they were spoon-feeding their babies or feeding purées. If parents were spoon-feeding or giving purées 10 percent of the time or less, they were classified as BLW, otherwise they were classified as SW. This classification was used by the authors of the study as there is no official definition for BLW.

After analysing the data that was gained, women in the BLW group were found to have significantly higher education compared to the SW group (phase one). In phase two all the children were fully weaned, meaning they ate a wide variety of family foods at regular mealtimes. While the mean breastfeeding duration was 26.11 weeks with no significant difference between the two groups, children from the SW group were introduced to solids earlier then children from the BLW group. Between the two methods there were differences found in maternal child feeding style. Mothers from the BLW group reported lower concern for child weight, less pressure to eat, less restriction and monitoring compared to mothers from the SW group. There were also slight differences found between the groups concerning child eating behaviour. Children who were introduced to solids on a BLW approach were reported to be significantly less food-responsive, less fussy and more satiety-responsive compared to the SW group, while there was no difference found for enjoyment of food. Infants who were weaned earlier, were reported to be more fussy at 18-24 months. The timing of the introduction of finger foods was also found to be linked to food-responsiveness of the children. Infants who were given whole foods or finger foods earlier were less food-responsive.

Furthermore, significant links were found between maternal control and child eating behaviour. High restriction levels were associated with lower satiety-responsiveness and high concern for child weight seemed to encourage fussiness. At the same time a high pressure to eat led to a lower enjoyment of food and higher food-responsiveness, while high levels of restriction also led to a higher food-responsiveness (in the SW group) but a lower satiety-responsiveness in both groups. There was no difference found between the groups for fussiness. The negative effects of high maternal control were stronger in the SW group, which suggests BLW has some kind of protective influence on the children even if their parents tend to have higher levels of control over them. Finally, the infants from the BLW group were significantly less likely to be overweight compared to those from the SW group. These findings need to be treated with caution though, because the weight was self-reported and the overall number of children in an overweight-range

was small in this study. The results show the impact which the type of weaning approach and maternal behaviour and feeding style during the weaning period (6-12 months) have on later child eating behaviour (at 18-24 months).
As limitations to this study should be mentioned that the participants were self-selected concerning both, the participation and the style of weaning applied. It may be that parents who chose to be in the BLW group did so because of certain beliefs and expectations they already had about BLW. The eating behaviour and weight of the children were also self-reported, which is a potential risk for errors. Also the researchers established their own measures for categorizing BLW and SW because there is no clinical definition for the term BLW yet. This might also lead to differences whereas other definitions of BLW are used. The authors emphasize that further research should observe child eating behaviour and measure actual nutrient intake and weight rather than relying on the reporting of parents. They suggest a randomized controlled trial to ascertain the impact of BLW on child eating behaviour and weight among other factors.

Finally, a study in 2015 Cameron and her colleagues developed and tested a modified version of BLW which they called Baby-led Introduction to SolidS (BLISS) **(Cameron et al., 2015)**. This study addresses the concerns of healthcare professionals towards an inadequacy of the iron and energy intake, as well as the risk of choking when following BLW.
As the BLW approach is getting more and more popular among parents and families, given the above stated risks, the study aimed to develop a modified, “improved” version of BLW and compare the two concerning the aspects of iron adequacy, energy intake and choking risk.
BLISS was developed by the authors of the study in collaboration with a paediatrician and a paediatric speech-language therapist. It aims to lessen the most commonly perceived risks of BLW being increased risk of choking, risk of low iron status and risk of growth faltering due to an insufficient energy intake. The BLISS method consists of several essential characteristics including offering foods that the infant can feed themselves similar to a BLW approach, but additionally the method suggests offering one high-iron food at each meal, one high-energy food at each meal and food being prepared suitably according to the infant’s level of development to reduce the risk of choking, as well as avoiding high choking-risk foods. The difference between BLW and BLISS is mainly the level of specificity of the instructions, while the key characteristics remain the same.
The study was conducted in New Zealand. The participating parents were recruited through a newspaper advertisement in the Dunedin Star Newspaper, which is delivered to more than 43500

homes throughout Dunedin and its surroundings. The advertisement asked for parents who had an infant up to five month of age and were planning to use a baby-led approach of introducing complementary foods.

The method that was used to educate the parents about BLISS was a series of booklets that were discussed at individual meetings with the parents when their babies were 5,5 and seven month old. The booklets included the characteristics of BLISS as well as practical advice, e.g. "Include one iron rich food at each meal" and iron-rich recipes. The recipes used for BLISS were developed in the Department of Human Nutrition Bristol-Myers Squibb Metabolic Kitchen (University of Otago, Dunedin, New Zealand) and tested for suitability for being picked up and palatability as a family food. Recipes with high risk of choking, as decreed by the paediatric speech-therapist, where excluded.

There also was a pre-testing of the resources, i.e. the booklets were read by six parents for comprehension and acceptability and the content was optimized by rewording some phrases and adding more recipes. The booklets where also reviewed by six experts working in paediatrics, first aid and nutrition and afterwards some safety information was added or rewritten.

The recruited parents could choose whether they wanted to assign to the BLW group or the BLISS group. After the groups were formed, the BLW group had nine and the BLISS group had 14 participants, resulting in a total of 23 final participants, whose mean age was 31,2 years. More than half of them just had their first child (70%), had a university degree (65%), were New Zealand European (74%) and had a paid job (74%) at the time the study was conducted. There were no significant differences found between the BLW and BLISS groups for these demographic data, though.

After the groups were formed, participants in the BLISS group then received the two home visits mentioned earlier at 5,5 and seven month of age. Parents were advised to start BLISS when the Baby turned six months (i.e. 180 days). It was discouraged to start earlier to minimize choking risks and also to start later, because that might favour iron-deficiency. At seven months of age the infants were more developed compared to when they first started BLISS, so the second home visit included how to introduce new textures and food shapes to the infant's diet, as well as individual advice on the procedure in general. Participants in the BLW group didn't get any feeding protocol to follow but instead were asked to follow the BLW approach as they originally intended. Both groups where interviewed once per week for 12 weeks from six month of age. The data was collected through a baseline interview to gather demographic information, followed by structured phone interviews of 30 mins once a week for a subsequent 12 weeks (from six to

nine months). Of each group there was a subsample of five participants who completed a 24-h iron-questionnaire for 3 non-consecutive days. Another subsample of four participants per group completed a weighed diet record by weighing the given food on food scales and using the dietary analysis software Kai-culator. Descriptive food lists for iron-rich foods, high-energy foods and foods with high choking risk were developed with paediatric and nutrition experts. They were used to help the parents describe what the baby had to eat in the questionnaires.
After all data was collected and statistically analysed, the proportions of self-feeding, shared family meals and family foods eaten were compared between the two different groups at six, seven and eight months. No differences were found between BLISS and BLW regarding these aspects at any infant age. According to the 3-day iron records of the subsample, the amount of iron offered from complementary foods was not significantly different between the BLISS and BLW group, although the amount of red meat offered in the BLISS group was much higher. Furthermore the infants in the BLISS group were offered a wider variety of foods containing iron according to the weekly interviews completed by the whole sample. Most participants in the BLISS group also offered iron containing foods from the first introduction of solid foods onwards, i.e. from week one of complementary feeding (78,6% compared to 22,3% in the BLW group), as well as more serves of iron-containing foods per day (2,4 compared to 0,8 serves per day in the BLW group). According to the 3-day weighed diet records there was no significant difference found between the energy intake of the BLISS and BLW subsamples. At the same time both subsamples were offering the same amount of high-energy foods and low-energy foods (being fruit and vegetables) per day at six months of age. The variety of high-energy foods was greater in the BLISS group though, while the mean number of meals eaten by the infant per day was the same for BLISS and BLW groups at six, seven and eight months. The occurrence of choking episodes was not significantly different between the groups according to the weekly interviews. While two choking incidents were reported in the BLISS group, one was reported in the BLW group. The foods that had been reported to cause the choking were raw apple and grapes, which are both high choking-risk foods for young children, are even associated with fatal choking (Hayman et al., 2013) and should therefore be excluded from an infant's diet. None of the choking incidents required medical intervention, but they could be dealt with at home without any further difficulties. According to the weekly interviews infants from the BLISS groups were less likely to be offered high-choking-risk foods compared to BLW group at six and eight months, though, which was confirmed by the data of the 3-day weighed diet records. This probably originated from the BLISS parents additional education before starting complementary foods and

having specific information on which foods are considered to be high-choking-risk foods.
In their conclusion the authors of the study explain that BLISS was well accepted and implemented by the parents in the study. They notably offered more iron-rich foods and less foods considered high-choking-risk foods than those following the BLW approach and also offered their children a wider variety of high-iron and high-energy foods. The adherence to a baby-led approach, i.e. proportions of self-feeding, shared family meals and family foods eaten was not different between BLISS and BLW.
The authors emphasize that none of the eight infants whose parents completed the 3-day iron records did achieve the WHO recommendation for iron intake from complementary foods of 10,8 mg/day, meaning that both groups may be at risk of iron-deficiency. At the same time the increased portions of red meat offered in the BLISS group also leads to an increased protein intake, which has a number of possible effects including increased risk of obesity in later live (Michaelsen, 2000). However, bigger sample size is needed to test this, preferably with measures of biochemical iron status and investigation of protein intake on BLISS compared to other feeding methods in a randomized controlled trial.
While the strengths of this study are its prospective nature, the involvement of experts in the development of BLISS and a weekly follow up, it is imitated by a missing group of traditional weaning parents, no random assignment to the groups and only recruiting parents who already planned to use a baby-led approach beforehand, meaning that parents who felt confident about the BLW method would rather assign to the BLW group, while parent who felt they needed extra support would choose to assign to the BLISS group. Furthermore the sample size was very small and some important data was only collected from subsamples. The results should therefore be interpreted with caution and require confirmation by a larger, preferably randomised controlled trial. However, this study showed that the BLISS approach as developed by the authors is feasible and suggests the resources and methods to educate participants about BLISS are suitable to be used in a larger randomized controlled trial.

3 Evaluation

3.1 Discussion

Breastfeeding is the most efficient and natural way to provide nutrition to a new-born baby and is suited to fully nourish the child for the first months of their lives. As the infant grows, so does their need for energy and nutrients, causing the necessity to introduce complementary foods at around six months of age (World Health Organization, 2002).
Baby-led weaning is an alternative approach to the traditional use of spoon-feeding puréed foods for this introduction, that has been getting more and more popular over the last few years (Cameron, Taylor, & Heath, 2015) and being associated with numerous positive effects and health related outcomes (Brown & Lee, 2013). Same as the WHO, the BLW method proposes exclusive breastfeeding until six months, continuous breastfeeding on demand, but on the other hand it does takes pressure of the parents to introduce solids early, as they are advised to react to signs of readiness in the child (Arden & Abbott, 2014).

First and foremost, by its very nature BLW follows similar principles as breastfeeding on demand (Sachs, 2011). For mothers who breastfeed, BLW might therefore be a natural and logical progression (Brown & Lee, 2011a) as breastfeeding itself also is baby-led in terms of frequency, duration and quantity of feeding (Dewey et al., 1991). While they are being breastfed the infant is in control of the amount of the food taken (Bartok & Ventura, 2009), meaning that maternal control is being low during the breastfeeding process (Brown, Raynor, & Lee, 2011).
At the same time, choosing to follow BLW encourages longer breastfeeding duration (Harder, 2005) (Brown & Lee, 2011a), as well as exclusive breastfeeding for six months (Moore, Milligan, & Goff, 2014) and a later introduction of solid foods (Moorcroft, Marshall, & McCormick, 2011) (Brown, 2015) (Brown & Lee, 2015) compared to following a traditional weaning approach.
Overall, mothers following BLW introduce solid foods significantly later, while the mean age of their children was closer to the recommended age of six months (Brown & Lee, 2011a) (Cameron, Taylor & Heath, 2013).
Since 2003 the weaning guidelines in the UK match those of the WHO in recommending six months of exclusive breastfeeding (Department of Health, 2003), while more current literature suggests introducing solid foods around six months in response to certain developmental signs of

the baby (Department of Health & UNICEF, 2008). It has been suggested that the actual guidelines are too inflexible, and consequently cause conflicts when mothers try to act in response to their child's developmental signals (Arden, 2009).

Overall, an alarming number of women seem to be weaning their children earlier than recommended, as can be seen in several studies (Cameron, Taylor & Heath, 2013)(Brown, 2015). Study results of Moore et al. suggest that this is not necessarily linked to the knowledge about the existing guidelines, as 80% of the mothers in their study who weaned their child before 17 weeks of age did know that a later introduction was recommended. In total of 3607 study participants 13% of the babies were weaned before 17 weeks, 37% were weaned at 18-23 weeks, 25% at 24-25 weeks and 25% at 26 weeks (Moore et al., 2014).
There are various reasons for mothers to start the introduction of complementary foods, some of them being demographic like maternal education, socio-economic status and age (Alder et al., 2004), while others arise from infant characteristics like the baby's size, weight an gender, perceived signals of the infant and the parents having the impression of their baby being ready for solids (Bolling et al., 2007). In their study Moore et al. found that a poor understanding of the weaning guidelines was the most reliable predictor of an early introduction of solid foods, along with young maternal age, while following a baby-led weaning approach was the most reliable predictor for weaning at the recommended 26 weeks of age (Moore et al., 2014).
Mothers using BLW are significantly more likely to introduce solid foods later that those following an SW approach, the mean age of their children also being closer to the recommended age of six months (Brown & Lee, 2011a)(Cameron, Taylor & Heath, 2013) (Brown, 2015). Possible explanations for this are that parents who decide to follow a BLW approach wait until their children reach 6 months of age, which is the age when most healthy infants are considered developmentally ready to feed themselves (Northstone et al., 2001)(Wright et al., 2010) or it could be possible that parents who decide to use BLW are more aware of the recommendations. On the other hand parents who spoon-feed their children might be able to encourage their infant to eat solid foods earlier as the feeding or purées requires little active contribution from the child (Cameron, Taylor & Heath, 2013).

However, BLW does encourage parents to watch their infant for signs of being developmentally ready for the introduction of solid foods (Rapley & Murkett, 2008). In one study mothers using the BLW approach reported being aware of the relevant recommendations to introduce

complementary foods at six months of age and used this for orientation, although they also reported observing their infant for developmental signs of being ready (Brown & Lee, 2013). Sometimes though, babies seem to show these signs before the recommended six months of age. In the study by Arden & Abbott some parents reported their children simply grabbing and eating food from the parent's plate even though it was not actively offered to them before six months. In this particular study there seemed to be an inherent conflict between the determination not to introduce solids before six month and trusting the child to know when they are ready to have solid foods, although if solids were introduced before six month, the trusting of the child was used to justify this decision (Arden & Abbott, 2014). In another study parents knew about the BLW principle to start complementary feeding when the child shows certain signs, but only two mothers in the study started solids when their children reached out for food. All other participants started the introduction of solids on advice of their HP or because of following WHO guidelines (Cameron, Heath, & Taylor, 2012).

It is pertinent to highlight that the timing of introduction of complementary foods appears to be directly attributed to characteristics of the mother. In her study about the differences in eating behaviour, personality and well-being of mothers on a BLW compared to a TW approach Brown found evidence that mothers who had a higher BMI at birth and current BMI and whose infant was heavier at birth introduced solid foods earlier than mothers with a lower BMI or an infant weighing less at birth. Furthermore, mothers who showed high levels of anxiety, introversion and restrained and emotional eating were more likely to introduce solid foods early and a later introduction of solids associated with lower levels of maternal anxiety and obsessive-compulsive symptoms, but also with higher extraversion and conscientiousness in mothers, as well as lower levels of maternal restraint and emotional eating in both BLW and TW mothers. It is considerable that the level of maternal desire for control and monitoring are important factors for both decisions, the timing of introduction and the choice of feeding style, and that this level of desire is determined by anxiety and insecurity of the mother (Brown, 2015).
However, the reasons for deciding for or against a BLW approach are numerous. Many mothers seem to adopt this approach simply because makes sense to them (Brown & Lee, 2013), seems logical, seems less time consuming, more convenient or less expensive than traditional weaning (Cameron et al., 2012). Other parents choose to try BLW because their traditional approach has failed or because it fits their parenting style (Arden & Abbott, 2014). Another important factor for parents deciding to try BLW probably are the hopes and beliefs they have about positive

outcomes of the method, e.g. that BLW might help their children to develop healthy eating behaviours, adapting a healthy relationship to food and a healthy diet for the future, sharing meals with the family and eating a wide variety of foods (Cameron et al., 2012)(Brown & Lee, 2013)(Arden & Abbott, 2014).

Some parents feel more relaxed on a BLW approach as it has no detailed step-by-step weaning protocol but instead encourages parents to respond to their infants needs and that these fewer rules of BLW make the transition to solids easier and less frightening for parents (Cameron et al., 2012). By not having to follow a certain plan for introducing complementary foods, e.g. starting with semi-liquids and slowly transitioning to lumpier textures, BLW may lead to an overall experience that is perceived to be simple for all involved parties (Brown & Lee, 2013).

On the other hand the most common reasons for opposing BLW appear to be the parents' fear of choking, concern about their infant not eating enough, doubts about the infant's ability to self-feed and TW having worked fine for them in the past (Cameron, Taylor & Heath, 2013). Slow weight gain or health problems of the infant can also cause parents to choose TW over BLW as it allows them more control over the child's food intake (Brown & Lee, 2011b). Finally, HPs can have as much influence on mothers decisions about breastfeeding and weaning as cultural values and maternal resources (Abel et al., 2001) so a HP advising against BLW will probably be heard by the parents.

The primary information sources for parents who do decide to follow BLW seem to be friends and family-members, as well as external sources like books and most importantly the internet (Cameron et al., 2012), while mothers who choose a TW approach rather seek advice from their HPs (Brown & Lee, 2011a). It would also be possible that conversely mothers who rely more on the opinion of their HP choose the traditional as it is more likely to be recommended by them (Cameron et al., 2012).

Although mothers who spoon- or purée-fed their children introduce complementary foods earlier, mothers using the BLW methods introduced finger-foods earlier than them. That could be beneficial as a delay of the introduction of lumpy or whole foods has been associated with feeding difficulties in toddlerhood (Northstone et al., 2001) and toddlers also become more skilled in eating by receiving a wide range or differently textured foods.

Interestingly, it is thought possible that motor development aligns with the opportunity to learn, not necessarily with the increase of nutritional needs (Wright et al., 2010). That would mean to learn proper chewing and self-feeding skills, a baby needs frequent opportunities to practise

these and will become more skilled in self-feeding over time (Rapley, 2011)(Brown & Lee, 2011a). By giving the baby time and opportunity to explore and handle food without pressure, while breast milk still is the main source of nourishment, BLW aims to support infants in making a gradual transition to solid foods in their own time (Rapley, 2011).
For an infant hunger is unlikely to be initial reason for showing interest in solid foods. Firstly, they show interest in sharing their parent's activity and then over time learn how to bite, chew and swallow and subsequently learn about the satiating capacities of food (Rapley, 2011). As BLW enables infants to eat solid foods separately instead of mashed into a purée it might constitute a more stable learning about satiating capacities of food and therefore encourage better satiety-responsiveness (Brown & Lee, 2015).

Brown and Lee found that infants who were introduced to solids on a BLW approach were reported to be significantly less food-responsive, less fussy and more satiety-responsive compared to children who were weaned traditionally. The timing of the introduction of finger foods was also found to be linked to food-responsiveness of the children. Infants who were given whole foods or finger foods earlier were less food-responsive in the study. The results of this study suggest that infants who are weaned following a baby-led approach have better appetite-control and a lower BMI than children weaned on a TW approach (Brown & Lee, 2015). It was found that infants from the BLW group had lower levels of food-responsiveness and higher satiety-responsiveness, which could help lower the risk for child obesity as high food-responsiveness and low satiety-responsiveness have been linked to an increased risk for child obesity in the past (Johnson & Birch, 1994)(Carnell & Wardle, 2007). BLW therefore seems to provide an environment suited to develop and preserve eating patterns according to appetite.
It is probable that BLW provides the children with the possibility to obtain optimal satiety-responsiveness due to their ability to choose the pace and duration of mealtimes, food choice and actual food intake without parental influence (Brown & Lee, 2015). On BLW infants have greater opportunity to consciously end mealtimes while infants who are purée-fed often get a set portion-size by their parents. Also the participation at regular meals with the family may result in prolonged eating time and decreased eating speed, which has been associated with increasing signs of satiety (Sclafani, 1997). Babies have not yet the notion of habitual clearing of the plate, which is a psychological satiety sign for adults, so given the possibility babies could end a meal with no regard for what is still on the plate only because they feel they had enough to eat. This suggestion is consistent with BLW using parents' reports of their children being "a good judge" of

how much food they need and keep a natural and healthy hunger-satiation-regulation (Arden & Abbott, 2014). The ability to eat until full opposed to eating until the portion is finished may help to protect against being overweight or obese (Brunstrom, 2005). But while clearing the plate is a learned behaviour (Sclafani, 1997), eating until full seems to be natural for babies and children (Birch, Johnson, Jones, & Peters, 1993), an ability that has been shown to decrease during later childhood and adulthood (Rolls, Roe, & Meengs, 2006). As following a BLW approach seems to increase the likelihood of well-developed satiety-responsiveness, it could help prolong or protect the ability to eat according to appetite (Brown & Lee, 2015).

There are different explanations why BLW is linked to lower levels of food-responsiveness and higher satiety-responsiveness. First of all, BLW might merely be associated with other specific appetite traits like mothers who follow BLW being more likely to exclusively breastfeed for 6 months, introduce complementary foods later and use lower levels of control over their infants. It could also be linked to the fact that mothers who follow BLW mostly have higher education, which is associated with healthier child diet and weight anyway. However, Brown and Lee found a significant link between BLW and satiety-responsiveness that was independent of maternal control, breastfeeding duration, timing of introduction of solids and maternal demographic background (Brown & Lee, 2015).

Another possible benefit of BLW might be that it optimizes the learning process about the post-ingestive consequences of food, meaning that the look, taste, smell and texture of a food can become associated with post-ingestive effects (e.g. the food being satiating) after some exposures (Brunstrom, 2005). As BLW foods are presented in their whole form rather than puréed, therefore being more selectable and distinguishable than different flavours in a purée, using BLW might work in favour for this learning process. It might be possible that BLW enables an early and more stable learning about the satiating capacity of different foods, which might be the reason it tends to result in better satiety-responsiveness (Brown & Lee, 2015).

It is also possible that infants weaned on the BLW method develop other, potentially more healthy food preferences than traditionally weaned babies. Townsend and Pitchford could observe that carbohydrates were the most preferred foods of the BLW babies in their study, although the exposure to carbohydrates in the spoon-fed group was significantly higher, while the most preferred foods in the spoon-fed group were sweets. Being the bottom of the food pyramid, carbohydrates play an important role in a wholesome nutrition. A liking for carbohydrates opposed to the preference of sweets may therefore play a role for the development of lifelong healthy eating habits (Townsend & Pitchford, 2012).

Finally it seems Infants whose parents follow BLW are significantly less likely to be overweight compared to those being weaned traditionally (Brown & Lee, 2015). These results are conclusive with those of preceding research by Townsend and Pitchford. It therefore appears that using BLW promotes a lower BMI, which in turn could have important implications for the fight against obesity in our modern western society (Townsend & Pitchford, 2012). These findings need to be treated with caution though, because of infant weight being self-reported.

Another factor that has been shown to have positive influence on eating patterns is the occurrence of shared family meals. By encouraging healthy eating including an increased consumption of fruit and vegetables as well as a lower intake of foods considered unhealthy they play in important role in child nutrition (Hammons & Fiese, 2011) (Utter et al., 2013). So far this association has only been shown in children of two years and older, while the benefits for younger children who enjoy shared family meals yet remain unexplored. Family meals might have important influence on the development of children aside from their nutritional value though, by providing the opportunity to learn, communicate and take part in important family rituals (Story & Neumark-Sztainer, 2005).

Existing research about BLW suggests that mothers following BLW are more likely to offer fresh and home-made foods as first foods and at the same time were more likely to have their infants participate in mealtimes and having the same foods as the family compared to traditional weaners (Brown & Lee, 2011a)(Cameron, Taylor & Heath, 2013) (Arden & Abbott, 2014). Generally, mothers consider BLW to be a simple, convenient way to wean their children while this method easily fits with the family lifestyle and mealtimes (Brown & Lee, 2013)(Arden & Abbott, 2014). Mothers using BLW also reported that as the baby eats the same foods as the family there is less meal preparation involved and mealtimes were perceived as easy, more enjoyable and less stressful because parents and children could eat at the same time and no feeding by the parent was required (Cameron et al., 2012)(Brown & Lee, 2013). Having the infant eat the same food as the rest of the family is convenient as well as cost-effective. Sometimes an adaption of the timing of those shared meals as well as the foods consumed by the family is being made to suit the infants nutritional needs and hunger pattern (Brown & Lee, 2013). Opposed to this, a study by Rowan and Harris found no significant changes in the parents' diet took place during the first three months of weaning (Rowan & Harris, 2012), which would suggest that using the BLW method does not lead to dietary changes among parents when first introducing solids to their children. This could be problematic as the intake of fat and sugar of the parents in the study was

too high, energy intake was too low and the intake certain nutrients, e.g. folate were too low as well. On the contrary mothers from other studies that were following BLW that family meals were adapted for appropriateness and sometimes additional foods where offered especially for the infant to ensure suitability and nutritional value (Brown & Lee, 2013)(Arden & Abbott, 2014). Nevertheless, none of these studies did measure nutrient levels in the blood or found any health outcomes connected to nutrient intake.

Many mothers report the mess at mealtimes as the main disadvantage of BLW, but as the motor skills develop and the children get used to feeding themselves the mess seems to get significantly less (Cameron et al., 2012)(Brown & Lee, 2013). Furthermore, mothers who had tried both BLW and TW emphasized that both methods were messy, thus mess not being a problem exclusive to BLW (Cameron et al., 2012). The same appears to be true for the amount of food wasted during the feeding process (Brown & Lee, 2013).

Although parents' reported experiences with BLW tend to be positive (Brown & Lee, 2013) and many mothers who try BLW would recommend it to others (Cameron et al., 2012)(Cameron, Taylor & Heath, 2013), governments and HPs are still hesitant to recommend BLW, their main concerns being choking risk, energy intake and iron intake of the infant (Cameron et al., 2012). These risks partly match the main concerns of parents who conclusively choose not to try BLW (Cameron, Taylor & Heath, 2013).

As healthcare professionals can have as much influence on mothers decisions about breastfeeding and weaning as cultural values and maternal resources (Abel et al., 2001), their knowledge about infant feeding is important. However, it has been shown that the knowledge and experiences of healthcare professionals often differ and can lead to very different maternal approaches (Arden, 2009)(Wright, 2004).

A study by Cameron et al. pointed out that HPs who do know about BLW had heard the method mostly from friends and family rather than from patients. All HPs in this study thought that BLW could be beneficial for the family and the child, because of shared family meals and less mealtime battles, encourage healthier dietary behaviours by letting the child explore a wide variety of foods, better hunger-satiation-regulation in children, because mothers were less likely to control the amount of food eaten and they saw the analogy between BLW and breastfeeding on demand. They also suggested BLW might have developmental advantages, like better oral and chewing skills and enhanced fine motor skills. On the other hand, they had major concerns about the method including the risk of choking, mothers leaving their child alone with the food, mothers

maybe becoming competitive about their child's progress and increase choking risk, potential risk of growth faltering caused by an insufficient energy intake, risk of poor iron status, and the possibility that mothers might give their children highly processed foods like cereal bars. Some also thought BLW might encourage parental anxiety as the mothers would have to see the struggling and difficulties a child would have with the first attempts of self-feeding (Cameron et al., 2012).

Concerning energy intake Rapley emphasizes that parents' and possibly HPs' expectations what a baby will eat in solid foods between six and twelve months are much higher than what the infant really needs and that a rapid increase in solid foods will lead to an automatically decreased intake of breast milk that is not beneficial for the child's development. As BLW allows the child to be in control of what and how much they eat, overfeeding is almost impossible and therefore BLW gives parents and healthcare professionals the opportunity to learn how much food babies really need (Rapley, 2011). Parents reporting that at first food was used merely as a toy and that it took quite some time until their baby started to eat the food on the purpose of satiety (Arden & Abbott, 2014) would therefore not be a problem. Instead breastmilk should continue to play a large role in the babies' nutrition until it is one year old and babies should not consume large quantities of solid foods before that age, so the milk intake does not become diminished too fast and energy and nutrient intake remains optimally balanced (Rapley, 2011).
The fact that most commonly reported first foods introduced to the babies on BLW are fruit and vegetables (Cameron et al., 2012) (Cameron, Taylor & Heath, 2013) does support the HPs' concern about energy intake, although the BLW method does allow and encourage parents to offer high-energy foods to their infant (Rapley & Murkett, 2008). The modified baby-led feeding approach called baby-led introduction to solids (BLISS) showed that parents who are given more specific information about different kind of foods and recommendations on how often to feed them did give their children significantly more high-energy foods (Cameron et al., 2015).

Another commonly perceived risk is the possibility of an insufficient iron intake and subsequent suboptimal iron status. As explained in the first part of this paper healthy infants with a normal birthweight are considered to be getting sufficient iron from being fed breastmilk and from the redistribution of iron from haemoglobin to iron stores during the first six month of life (Domellöf, 2011)(Kramer & Kakuma, 2002), but in the second half of their first year iron becomes a critical nutrient for the child, what makes an early introduction of iron-rich foods so important

(Anderson & McLaren, 2009) (World Health Organization, 2002).
Iron intake of infants does occur to be a mayor issue worldwide as it is (Chaparro, 2008) and in many countries (including NZ and the UK) it is customary to feed iron-fortified baby-cereal as one of the first introduced solid foods. Due to its semi liquid consistency though, iron-fortified baby-cereal is not suitable for BLW, because it would require spoon-feeding (Cameron, Taylor, & Heath, 2015). In fact following BLW leads to the usage of iron-fortified baby-cereal being less likely although some parents reported adjusting BLW and including some spoon-feeding to insure sufficient iron intake (Cameron, Taylor & Heath, 2013)(Arden & Abbott, 2014). With the most commonly introduced foods on BLW being fruit and vegetables which are generally low in iron (Cameron et al., 2012) (Cameron, Taylor & Heath, 2013) this adjustment seems sensible, while actually iron rich foods like eggs and meat are supposed to be fed from the start. That means infants on BLW could have excellent iron sources at hand in addition to breastmilk that is containing iron in low, but biologically available levels (Rapley, 2011). Meanwhile, infants on the BLW method do receive family foods more often (Cameron, Taylor & Heath, 2013) (Brown & Lee, 2011a) (Arden & Abbott, 2014), resulting in having a greater potential for a wider variety of iron-rich foods, e.g. if pieces of cooked red meat are offered. The bioavailability of iron from these foods is much higher (15.5%) than from infant cereals (3%) (Dube et al., 2010). As with energy intake, more specific instructions about which iron-containing foods are appropriate at what age and how often to feed them did lead to parents feeding their children more high-iron foods on the BLISS method (Cameron et al., 2015)

Finally, HPs and parents alike share the concern for the infant choking on food. However, Rapley claims that reasons for choking mainly are wrong posture of the body (e.g. leaning back), lack of concentration or wrong eating technique. This wrong eating technique in turn may be implemented by an early introduction of spoon-feeding puréed foods. Babies who are introduced to complementary foods in form of spoon-fed purées before they are able to bite and chew use suction to get the food of the spoon (Naylor & Morrow, 2001) which rapidly pushes the food to the back of the throat for swallowing. Consequently, the feeding of puréed foods encourages babies to swallow food without chewing and might put the child at a greater risk of choking than the self-feeding of finger foods, where bitten of food pieces stay at the front of the mouth and help the baby to learn how to chew (Rapley, 2011). Furthermore, real choking seems to be uncommon on BLW (Townsend & Pitchford, 2012) (Brown & Lee, 2013), while gagging, which is a normal reflex of a young child, is much more frequent. Gagging is a safety mechanism that helps

to prevent choking, as it results in pieces of food that are yet too big to be swallowed being returned to the front of the mouth for further chewing (Rapley, 2011). In six months old children the gag reflex is much further forward in the mouth than in older children and over time moves backward during the first year of age (Naylor & Morrow, 2001), that means babies being fed using a BLW approach gag a lot when first starting solids but over time the gagging recedes, which indicates that the gag reflex helps babies in learning oral motor skills and in fact ensures their safety when eating solid foods (Rapley, 2011). If choking does occur, being mostly caused by foods considered unsuitable for a baby under one year, it seems the baby usually expels the food by coughing and no medical intervention is needed (Cameron et al., 2012)(Cameron, Taylor & Heath, 2013). Again, more detailed information about high-choking risk foods did result in parents not giving them to their parents on the BLISS method, showing that information is of the essence (Cameron et al., 2015).

Despite the perceived risks it is probable that the usage of BLW does encourage many of the positive health outcomes stated above. What remains unclear though is if it is possible that maternal characteristics like anxiety or the desire to introduce complementary foods early prevent parents from following a BLW approach instead of BLW resulting in the absence of these emotions (Brown & Lee, 2011a). It cannot yet be securely stated whether the feeding methods behind BLW have a positive effect on children's eating behaviour and weight or whether maternal characteristics, attitudes and concerns influence these outcomes (Brown & Lee, 2011b). Furthermore whether following BLW causes lower levels of maternal control or if mothers who tend to be less controlling choose to follow a BLW approach to weaning is yet to be determined (Brown & Lee, 2011b)(Brown & Lee, 2013). Mothers in the latter study did explicitly reported feeling that following BLW had improved their choices and lessened their need for control over the infant's food intake, as well as having improved the family diet, though. Some BLW mothers also reported incidentally having concerns but getting more and more relaxed about their child's food intake along the way when seeing that they infant was healthy and gaining weight (Brown & Lee, 2013).

When using a BLW approach parental control is minimal, as the infant decides what food items they will eat, how much of it and at what speed (Brown & Lee, 2013). At the same time parents using BLW show significantly lower levels of restriction, pressure to eat and monitoring compared to TW users, while they are also less concerned for their child's weight (Brown & Lee,

2011b)(Brown & Lee, 2013). As maternal concern and maternal need for control over food intake, resulting in pressure to eat or restriction of foods, is associated with increased fussiness and poorer eating habits in children (Ventura & Birch, 2008). While restriction of food-intake can lead to increased intake when there is free access to food (Joyce & Zimmer-Gembeck, 2009) and therefore promote weight gain (Faith et al., 2004) and on the other hand pressuring a child to eat can lead to increased fussiness (Galloway et al., 2005) (Farrow, Galloway, & Fraser, 2009), BLW encouraging parents to trust their children with choosing the foods according to their needs, as long as healthy and nutritious foods are being offered to them in a wide variety, seems to be a sensible approach. It is possible that a low level of maternal anxiety and control may promote a permissive maternal feeding style in later years and therefore have positive impact on children's eating behaviour and weight status (Brown & Lee, 2011a), that feeding style not necessarily being strictly adherent BLW though. Furthermore, previous research has shown that mothers high in restraint are more likely to use a feeding style high in restriction (Fisher & Birch, 2002) and monitoring (Tiggemann & Lowes, 2002). As a TW approach allows higher control over the infant it might therefore be likely to be chosen by mothers showing high level of restraint, which is also associated with overeating (Rodgers et al., 2013) and overweight in children (Ogden, Reynolds, & Smith, 2006).

It is plausible that mothers using BLW show significantly lower levels of anxiety (Brown & Lee, 2011a)(Brown & Lee, 2013)(Brown, 2015). In the past anxiety could be linked to a more controlling child feeding-style (Mitchell et al., 2009), as well as a more authoritarian style of parenting in general (Metsäpelto & Pulkkinen, 2005). Furthermore, anxiety is associated with lower confidence (Ebstrup et al., 2011) and greater risk perception (Suls & Martin, 2005). A high level of anxiety might therefore cause parents to choose a TW over a BLW approach, because the feeding process allows more control and the acceptance of the method is greater, while at the same time there are more possibilities to get advice, support and information from literature and healthcare professionals (Brown & Lee, 2013). Indeed, these same maternal characteristics have been shown to be associated with a shorter breastfeeding duration (Brown, 2014), as breastfeeding is always baby-led with mothers having very little control over the amount taken by the infant (Brown et al., 2011)(Brown, 2015).

Mothers following a BLW approach are not always free of the desire for control though. Although BLW mothers generally trust their child about making the right choices and eat according to their need, some parents do report the desire to monitor the amount and types of food being eaten, which is very difficult on BLW. But parents can control the type of food their children eat by

choosing the type of foods they expose them to. This generally means offering a range of healthy foods and withholding treats or foods that are perceived as unhealthy (Arden & Abbott, 2014). Overall, BLW mothers apply lower levels of maternal control and therefore allow their infant to self-regulate their food intake compared to SW mothers (Brown & Lee, 2011b)(Brown & Lee, 2013) (Brown, 2015) leaving the possibility for an responsive feeding style that is beneficial for healthy eating behaviour and weight in the child (Ventura & Birch, 2008) (Benton, 2004).

Other than lower levels of maternal control and anxiety, mothers who choose BLW generally have significantly longer education, were more often married and in a professional or a managing occupation than women who spoon-fed their children, while being less likely to be returning to work before their baby was one year old (Brown & Lee, 2011a) (Brown & Lee, 2011b)(Brown, 2015). A possible explanation for this is that information about BLW is not widely available through HPs and not included in official health guidelines, but needs to be specifically sought out via books or most commonly the internet. Internet usage is associated with above average education (Gosling et al., 2004)(Im & Chee, 2006), although getting increasingly accessible for the general population in industrialised countries (Bell et al., 2010).
Understanding how maternal characteristics interact with feeding style is important, because if BLW was to be established as a way of promoting healthier eating and weight gain, certain character traits of the mothers might limit or modify the feasibility of the method or change the outcomes of its appliance (Brown, 2015).

In a study conducted in NZ with a population based sample it was found that a considerable number of the local respondents had never heard of BLW before (38% of 199 mothers), but after hearing about BLW of the study many of them declared being willing to try the method. Adding up the parents willing to try BLW and those who reported already using a baby-led approach resulted in 79% of the participants being willing to adopt the BLW method at least to a certain extent (Cameron, Taylor & Heath, 2013). This suggests a general interest in the method, although the results are hardly representative for other populations.
Meanwhile, from a developmental point of view BLW is considered suitable for most infants but could be problematic for children that are developmentally delayed (Wright et al., 2010).
Mothers who have tried BLW all usually recommend the method, although some do prefer a mixed approach of BLW combined with some spoon-feeding if necessary, e.g. when the child is sick, to ensure sufficient nutrient intake or when the child is in the nursery (Cameron et al.,

2012)(Cameron, Taylor & Heath, 2013). This mixed approach is also considered beneficial by Wright et al. (2010). Sometimes children may want to eat food they cannot yet pick up and eat by themselves yet, but it is still baby-led by parents to feed these to their babies when the infant makes clear that they want it (Arden & Abbott, 2014). This might be necessary as Wright at al. (2011) found that some children's desire for solid foods does not develop at the same speed as their self-feeding skills. Additionally, parents can encourage their infant to hold the spoon themselves, when semi-liquids or purées are to be consumed (Arden & Abbott, 2014). Adjustments made to BLW in existing studies suggest that the self-feeding of the infant following BLW principles combined with some small proportion of spoon-feeding is a practicable and realistic approach (Cameron et al., 2012)(Cameron, Taylor & Heath, 2013)(Arden & Abbott, 2014).

3.2 Conclusion

Overall, the advantages of a baby-led approach to infant feeding and the introduction of complementary foods appear to be prominent. It is probable that BLW is a weaning method that is suitable for most parents of a healthy, normally developed infant, as long as they are not limited by a disproportionate amount of desire for control or parental anxiety. The challenges one is facing on a baby-led approach do not seem to exceed those of traditional weaning and can be coped with if certain adjustments are made. The health related outcomes of following BLW appear promising, although existing study results do need confirmation.

The existing body of research faces a number of general limitations. While all samples of existing studies are self-selected and therefore susceptible for certain bias, the samples are also often not representative, because specific targeting of people using BLW was applied. This was necessary to collect comparable sample sizes though, as BLW is not yet established as a mainstream method. However, many of the studies contained only small sample sizes and were of qualitative nature.

Another problem is the lack of an official definition for BLW which resulted in different definitions being used in different studies. E.g. while Brown and Lee classified parents as BLW when they were using spoon-feeding or purées 10% of the time or less, in other studies BLW was simply self-defined by parents who participated in the study (Townsend & Pitchford, 2012) (Cameron, Heath, & Taylor, 2012). These different definitions make the results of the studies less comparable.

Furthermore, as there are no or little mainstream sources for information about BLW, parents who chose this method were predominantly white people with higher education, a population group that is associated with increased internet access (Gosling et al., 2004), which is also one of the main information sources for parents following BLW (Cameron et al., 2012). The recruitment of participants also took place via internet in many studies, further enhancing this tendency. Finally, data like food intake and weight was not measured, but estimated and self-reported by the study participants. Self-report is, although being a standard procedure when assessing food intake and preferences, vulnerable to error because of selective perception and self-deception.

3.3 Remaining Questions

The existing research, which is predominantly of qualitative nature, does offer important insights into the principles, implementation and outcomes of BLW. However, there are many questions remaining to be answered.

Firstly, a more differentiated and exact measure of the nutrient and energy intake of infants on different weaning approaches and an exploration of the short-term and long-term impact of the differences between the feeding styles are advisable. Researchers should preferably observe food intake and measure weight themselves instead of relying on self-report. Health indicators like biochemical iron status in infants on TW and BLW should be included to validate or dispute commonly expressed concerns about BLW. It also needs to be investigated if a delayed ingestion of solids, which may take place while following BLW, has nutritional effects for the infant and to what extent.

Additionally the influence of maternal control during the weaning period among other factors, including the choice of weaning style, is yet to be determined. Is BLW also feasible for mothers with a high desire for control, high anxiety and high in restraint? Is a low level of maternal control is truly beneficial for the child or if they maybe need to be encouraged to eat solid foods when these are first introduced? It would be very interesting to see if the choice of feeding style, among these other factors, has an impact on child eating behaviour and child weight in the future.

Furthermore research is needed about the suitability of BLW for infants who experience feeding or weight problems, as well as developmentally delayed infants.

A large controlled prospective study could help to verify the relationships between feeding

method and health outcomes as well as examine further coherences between the weaning practices and other key factors during infancy (e.g. BMI, milk feeding practice, SES etc.). Meanwhile, a longitudinal study would help to determine the direction of correlations between parental characteristics, parental feeding style and certain health outcomes. Also, an examination of the use and occurrence of BLW in population based samples is needed to explore the prevalence of BLW in general populations.

Overall, bigger sample sizes and preferably randomized controlled trials would be suitable to confirm or invalidate the qualitative results of existing studies.

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