Baby foods in the UK

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FIRST STEPS NUTRITION TRUST

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ISBN 978-1-908924-43-8 Hard copy
ISBN 978-1-908924-44-5 ebook

Published by First Steps Nutrition Trust, 2017.

Disclaimer

We have looked at jars and pouches of baby food marketed for infants in the UK and provide information about products in good faith. This is a dynamic market and products and brands change, so some products highlighted here may no longer be available. We have highlighted issues about particular products, but this does not mean these products are unique and the same issues may relate to a range of products from different manufacturers. The intention is to provide some food for thought for those who advise families about how to feed infants in the first year of life. Anyone wanting individual advice about food and health for an infant should talk to their GP or health visitor.

Acknowledgements

This resource was written by Dr Helen Crawley and Susan Westland. We would like to thank all the manufacturers who answered questions we asked and provided information about their products. Thanks also go to Helena Little for the food photographs, and to Jennifer Crossan, Rosie Dodds, Bahar Ghodsian, and Sian Robinson.

Edited by Wordworks.
Design by Sally Geeve.

Photo resources

For information about photo resources for different age groups of children and young people, see the website www.firststepsnutrition.org

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Executive summary

There is increasing interest in the development of eating habits in infancy and how this may impact on later eating habits, development and body weight. Global and national health bodies recommend that babies receive complementary foods alongside breastmilk from about 6 months of age. Between the ages of 6-12 months, infants are encouraged to experience a wide variety of minimally processed foods and different tastes and textures so that in the second year, and beyond, they eat and enjoy healthy family foods.

Commercial baby foods have been marketed for over 100 years as suitable first foods for infants. However, with changing evidence and thinking about how we introduce solid foods, the need for soft, highly processed and frequently sweet foods in the first year is being questioned.

Increasing the intake of vegetables is seen as a public health priority, and intakes among many children remain low. Liking for vegetables is thought to be linked to serving individual unmixed vegetables to infants, rather than hiding savoury and bitter flavours in sweeter foods, and a 'vegetables first' approach is now thought to promote vegetable-liking in childhood.

The quality of food served in the early period of life is related to later adiposity in children, and with almost one in four children starting school overweight or obese, there is increasing interest in how early eating habits may impact on later food and drink choices. Reducing sugar intake, and reducing a preference for sweet tastes, in childhood are currently recommended and so it is timely to review how commercial baby foods align with current public health advice on eating well in the first year of life.

This report looks at the most common brands of commercial baby foods sold in jars, pouches (and in a few cases, trays) marketed in the UK for infants in the first year of life. It reviews the composition, ingredients, nutrition, texture, cost, packaging and claims of 343 products produced by the four main manufacturers of jars and pouches of baby food marketed for infants – Cow & Gate, Ella's Kitchen, Heinz and Hipp Organic – available on the UK market between August and October 2016. These four manufacturers represented 89% of the total market share (value) of the baby food and drink market in the UK in 2015 (Mintel, 2016). The key points from the report are highlighted on the following pages.

This review looks at the four most common brands of commercial baby foods sold in jars and pouches marketed in the UK for infants in the first year of life – Cow & Gate, Ella's Kitchen, Heinz and Hipp Organic.

Age foods are marketed from

- In the UK, almost half of all the baby foods for infants in the first year produced by the four biggest manufacturers of baby foods in jars and pouches, are marketed for those under the age of 6 months. This is despite public health guidance in the UK that complementary foods should be introduced at around 6 months of age. All manufacturers should market baby foods from 6 months of age in line with public health guidance, to ensure that families receive consistent information about the appropriate age to introduce solid foods.

Carbohydrates and sugars

- There is a predominance of sweet baby foods on the market for infants. This is of concern, as a high sugar intake is linked to poor oral health, may accustom infants to very sweet tastes, and may contribute to overweight in later childhood. A diet free from added sugars in the first year of life is recommended.
- Processed puréed baby foods based on fruits (and some vegetables) have a high free sugar content and should be avoided. The sugar content is likely to be much higher in puréed foods than appears on the label, as the products are highly macerated and heat-treated. More data is needed on the impact of processing on the sugar content of fruit and vegetable purées.
- Processing of carbohydrates at high temperatures may also result in the development of contaminants in foods (for example, acrylamide, furan, 3-deoxyglucosone). Maximum allowable levels of degradation product contaminants that have been linked to health risks should be established for baby foods.
- Some infant foods are sweetened with fruit juice and added sugar, and these products should be phased out.

Vegetables and fruit

- Manufacturers use fruit and vegetables to provide sweet flavours, even when the dish appears to be a savoury option. Single-flavour commercial first fruit and vegetable purées are expensive and high in sugars, and are likely to lack the authentic taste, texture and appearance of simple, home-made versions.
- There is no evidence that mixing sweet flavours with vegetables helps infants to accept vegetable flavours, but manufacturers provide few simple vegetable tastes. When fruits and vegetables are combined, the name often does not reflect the main ingredient, and many of these products have a very high proportion of puréed apple or pear, even when this is not highlighted in the name. All product names should reflect the ingredients present, so that care-givers are not misled into thinking that they are offering savoury vegetable tastes when this is not the case.
- The main vegetable used in many mixed savoury dishes is carrot, often in combination with other sweeter vegetables such as tomato, sweet potato, parsnip and squash. Few savoury meals have cauliflower, broccoli or other green vegetables as the main vegetable without a sweeter one added as well.
- When claims are made for the number of fruit and vegetable portions in a product, it is not clear how these are calculated, and there is some confusion over the number of portions, and the number of types of vegetables, highlighted on labels.

Micronutrients

- Current infant feeding recommendations are to offer a wide range of simple, minimally processed foods (including meat, fish, eggs, pulses, vegetables and cereals) to infants from about 6 months of age and this will ensure they have a good intake of micronutrients. High-heat processing of commercial baby foods may mean that many have low or minimal contents of some micronutrients. More information is needed on the micronutrient content of highly processed baby food, and manufacturers are encouraged to be transparent about any analysis of products they carry out.
- The iron content of baby foods is highly variable, but many foods are low in iron and the small amounts of meat and fish used in many dishes are likely to contribute lower amounts of iron (and zinc) compared with home-made equivalents.

Water as an added ingredient

- The water content of baby foods is not made explicit on all labels. The water content of many commercial baby foods is greater than is likely to be present in home-made food, and this means that the energy density of the food is likely to be lower. A baby therefore needs to eat a high volume of most commercial baby food to obtain the energy and nutrients found in a smaller portion of home-made food.

Energy density and portion size

- The energy content of commercial baby food is highly variable across products and many commercial foods have a low energy density. However, the portion sizes of many commercial baby foods are large, and despite the lower energy density, a portion frequently exceeds our estimated energy requirements at meals. Almost all main meal savoury meals and desserts for infants aged 10-12 months exceeded our estimates of energy requirements for that age group.
- Despite some manufacturers' claims that meals are 'nutritionally balanced', how they calculate this, or what it relates to, is unknown.

Texture

- Most commercial foods marketed for infants in the first year are smooth, or smooth with soft lumps, and it is likely that most infants are able to manage a faster progression to mashed and chopped foods than these products encourage.
- Puréed foods offer a different taste and texture profile compared to the foods they are made from, pass rapidly through the mouth and may limit appreciation of flavours. They may also lead to over-eating, as food that can be rapidly swallowed makes it more difficult for care-givers to know when the infant has had enough to eat

Ingredients used in commercial baby foods

- All baby food manufacturers must comply with regulations to ensure a low content of pesticide residues and other harmful contaminants in foods marketed to infants. Regardless of whether baby foods are made from organic or conventionally grown ingredients, these regulations are the same. The term 'baby grade' has no official meaning.

Ingredients not recommended in the first six months of life

- A number of foods marketed to infants under 6 months of age still contain ingredients that are not recommended in the diet before 6 months of age in the UK, such as gluten, egg and cows' milk. Marketing all foods from 6 months of age allows a wider range of ingredients.

Meat and fish content

- Most baby foods containing meat and fish contain the minimum amount required to meet regulations. By naming a meat product with a descriptive name (for example, 'Scrummy lamb hotpot' instead of 'Lamb hotpot'), or putting another ingredient first (for example 'Carrot and lamb hotpot'), the meat or fish content can be significantly lower (8%, compared to 10% if meat or fish is the first word in the name of the dish). The meat or fish content of many baby foods is likely to be significantly lower than in home-made dishes, which may contribute to commercial foods having a lower energy and nutrient density, as well as lower amounts of some micronutrients such as iron and zinc compared to home-made foods.

Protein

- The protein content of commercial baby foods is sufficient, but infants often have to eat large volumes of food to obtain the protein present. Home-made foods are likely to have greater amounts of higher protein ingredients and will therefore be more protein-dense, and also have higher amounts of iron and zinc.

Fat and fatty acids

- Cow & Gate and Hipp Organic use rapeseed oil in their foods to make claims about the amount of the omega-3 fatty acid alpha-linolenic acid (ALA) present. Recent research suggests that the ALA content of the oil used in baby foods may be significantly reduced during processing, with very small amounts present in the food. More information is therefore needed as to whether the values used for claims on packaging are analysed, or calculated, values.

Salt

- The salt content of commercial baby foods marketed in the UK is low, but some more salty ingredients are included and may give the impression that foods such as cheese and ham in unspecified amounts are suitable for infants.

Packaging

- Baby food is marketed primarily in jars and pouches, with pouches becoming increasingly popular. However, pouches are a more expensive way to buy baby food, and there are risks that children will eat directly from the pouch. Sucking directly from a baby food pouch should be avoided as this may impact on oral health, does not allow children to see the food they are eating, and does not allow infants or care-givers to know how much they are eating. Sucking from the pouch changes eating from a chewing to a sucking experience. Clearer warnings are needed on pouches, and in advertising, to deter parents from allowing children to suck directly from the nozzle.
- Pouches are not recyclable and as the number of foods marketed in pouches is increasing, an analysis of the environmental impact of this in the UK is recommended.

Food safety

- The preparation, warming and safety instructions on baby food jars, pouches and trays vary. Clear, consistent instructions across products are needed. All products should clearly state that babies should never be left alone when eating, as this is the most important thing to do to prevent choking and is not consistently stated on the packaging.

Cost of commercial baby foods

- Commercial baby food varies in price across brands, with food in pouches costing significantly more per 100g of product than food sold in jars. Families are paying a high price for convenience, and many of the commercial baby foods are poor value for money when compared with home-made foods made using higher proportions of more expensive ingredients.

Labelling and marketing

- Manufacturers use a range of marketing techniques to promote the use of commercial baby foods, emphasising the convenience and healthiness of products.
- Health claims should not be allowed on any foods marketed to infants and children, as these can mislead purchasers into thinking that commercially produced foods are superior to home-made foods or to alternatives that are minimally processed or unprocessed.

Introduction

What is the aim of this report?

Commercial baby foods have been produced since the turn of the 20th century and marketed to families as convenient and appropriate alternatives to home-produced food. They are ubiquitous in supermarkets, small shops and pharmacies in the UK, and are sold as dried products, snacks, foods in jars, pouches, pots and trays, and drinks.

The aim of this report is to review the commercial baby food market in the UK, focusing on foods sold in jars, pouches and trays for infants in the first year of life. The aim is to consider the composition, ingredients, nutrition, texture, cost, packaging and claims of these products.

This report looks at foods in jars, pouches and trays marketed to infants by the four biggest baby food brands, but excludes fresh yoghurts. The UK baby food market (excluding snacks and drinks) was worth £181 million in 2014 (Mintel, 2016).

We have also done some practical comparisons of commercial and home-made versions of foods, to illustrate why we believe commercial foods do not meet current guidance on the introduction of solids.

We hope this report will support health professionals when talking to families about introducing solids and helping their infants eat well in the first year of life. We hope it will also encourage discussion and debate about the value of commercial baby foods, and support families to feel confident about giving their infants cost-effective, home-prepared foods as part of family meals.

A brief history of commercial baby food

Commercial baby food was first mass marketed in the 1920s, and the history of the developing market for baby food in the US has been well documented (Bentley, 2014). Mass-produced baby food, predominantly sieved, canned vegetables and fruit, was launched alongside mass advertising campaigns to both mothers and health professionals. 'Scientific motherhood' – the belief that women required expert scientific and medical advice to raise their children – was promoted heavily in the early part of the 20th century (Apple, 1995). Many of the established ideas relating to infant feeding were altered through the production and marketing of new products, and this fundamentally changed infant feeding practices. For example, in the 1930s baby food funded research published in dietetic journals promoted commercial baby food as a good source of nutrients, despite evidence showing that the amounts in those foods were lower than in home-made foods (Bentley, 2014).

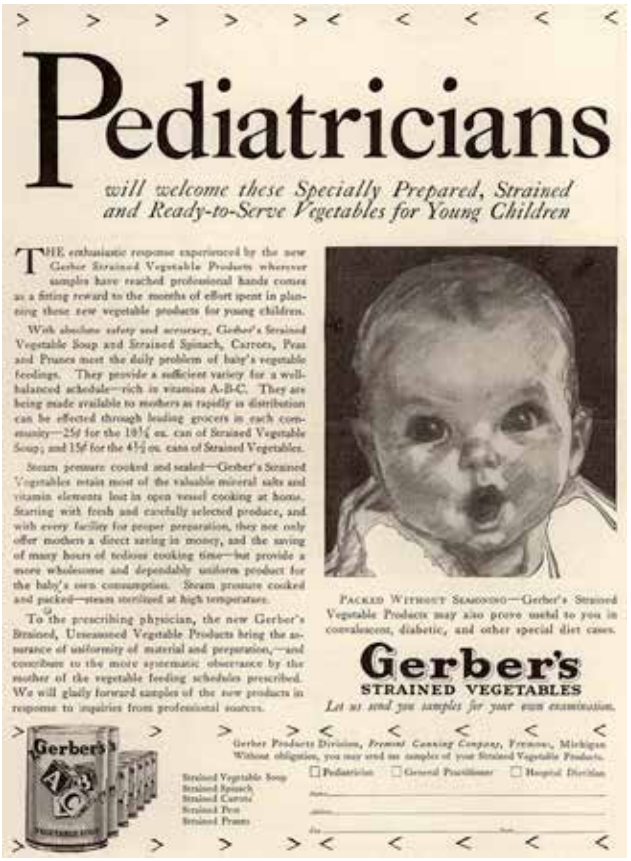
Promoting the idea that something 'scientifically prepared' was safer and reliably uniform in composition, which took hours of work away from harassed mothers, and which was more nutritious, has been at the forefront of advertising of baby foods ever since (Bentley, 2014). In the late 1920s, fruit and vegetables were typically introduced at around 7 months of age to predominantly breastfed babies but, alongside increasing marketing and production of baby foods, paediatricians and self-styled infant feeding experts began to encourage earlier introduction of solids. Post-war, the baby food producers broadened their marketing techniques with free samples, coupons given from birth, and direct mail campaigns to mothers and health professionals that encouraged even earlier introduction, undermining a mother's confidence in how to feed her baby. By 1960 in the US, Gerber, the largest baby food manufacturer, was spending $3.8 million on TV advertising alone, of a total advertising spend of over $8 million.

The acceptance of smooth, puréed baby foods as the 'normal first food for babies' has endured since that time. Interestingly, there have always been misgivings that commercial processed foods are suitable for infants. In 1943 Norman MacNeill, a physician, wrote in a medical journal that:

> *"Canned baby food inhibits the normal development of the swallowing mechanism, as well as the gustatory sense, for the development of a satisfactory appetite implies the conditioning of a group of reflexes to the sight, sound, smell and taste of food. The sight, smell and taste of some of the commercially prepared foods given to infants are poorly calculated to condition reflexes to the appreciation of palatably prepared fresh food."* (MacNeill, 1943)

This was, however, the minority opinion in a world increasingly dominated by the view that 'modernity' in all things was the way forward. By the 1970s, American babies were fed an average of 864 jars of baby food in their first year, and 74% of babies were also formula-feeding (Bentley, 2014). The result was that, from a very young age, babies were introduced to and acclimatised to the tastes and textures of industrially processed food and also missed the advantage conferred by breastfeeding for acceptance of taste variations. Limited exposure to varying tastes, colours and textures of foods impacts on preferences and food acceptance in later life (Harris and Coultard, 2016). It has been suggested that feeding infants bland, sweet, highly processed foods puts them on a pathway to a lifetime of consumption of highly processed foods, one of the causes of the rising rates of overweight, obesity and other chronic diseases (Bentley, 2014).

Whilst there has been extensive discussion on the marketing of breastmilk substitutes, similar techniques have been used to market baby foods. For example, in 1995 Gerber was charged by the Federal Communications Committee with producing misleading advertising in the US for the statement *"4 out of 5 doctors recommend Gerber baby food"*, when in fact the study referenced showed that 88% of doctors had no opinion on baby food brand at all (Bentley, 2014). Aggressive marketing of baby food for children at younger ages feeds into the anxiety of mothers feeling pressure to demonstrate their love


Pediatricians

will welcome these Specially Prepared, Strained and Ready-to-Serve Vegetables for Young Children

THE enthusiastic response experienced by the new Gerber Strained Vegetable Products wherever samples have reached professional hands comes as a fitting reward to the months of effort spent in planning these new vegetable products for young children.

With absolute safety and accuracy, Gerber's Strained Vegetable Soup and Strained Spinach, Carrots, Peas and Prunes meet the daily problem of baby's vegetable feedings. They provide a sufficient variety for a well-balanced schedule—rich in vitamins A-B-C. They are being made available to mothers as rapidly as distribution can be effected through leading grocers in each community—25¢ for the 10½ oz. can of Strained Vegetable Soup; and 15¢ for the 4½ oz. cans of Strained Vegetables.

Steam pressure cooked and sealed—Gerber's Strained Vegetables retain most of the valuable mineral salts and vitamin elements lost in open vessel cooking at home. Starting with fresh and carefully selected produce, and with every facility for proper preparation, they not only offer mothers a direct saving in money, and the saving of many hours of tedious cooking time—but provide a more wholesome and dependably uniform product for the baby's own consumption. Steam pressure cooked and packed—steam sterilized at high temperature.

To the prescribing physician, the new Gerber's Strained, Unseasoned Vegetable Products bring the assurance of uniformity of material and preparation,—and contribute to the more systematic observance by the mother of the vegetable feeding schedules prescribed. We will gladly forward samples of the new products in response to inquiries from professional sources.

PACKED WITHOUT SEASONING—Gerber's Strained Vegetable Products may also prove useful to you in convalescent, diabetic, and other special diet cases.

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Let us send you samples for your own examination.

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Without obligation, you may send me samples of your Strained Vegetable Products.
☐ Pediatrician ☐ General Practitioner ☐ Hospital Dietitian

Strained Vegetable Soup
Strained Spinach
Strained Carrots
Strained Peas
Strained Prunes

for their infants through the purchase of material goods. A recent report looked at how web marketing frames commercial baby food as a value-added part of complementary feeding practice (Fuentes and Brembeck, 2016). The authors concluded that commercial baby food was marketed as 'medical', 'fun' or 'convenient', with web material offering a range of images and ideals that provided a good fit with several 'mothering ideals'.

In recent years, baby food has changed considerably, with a move away from seeking healthcare professional endorsement to products designed to appeal to parents who seek out food varieties and flavours common to their own food choices. It is suggested that most baby foods are not geared to the child, or based on compositional recommendations, but rather are 'aspirational' dishes parents might enjoy, in a format they have historically been used to seeing.

The biggest revolution in recent years has been the 'pouch'. By 2013, one-third of all baby foods in the US were packed this way. Pouches are lighter and easier to transport, they mask the actual baby food inside, and attain a halfway status between baby food and other foods, extending the perceived time frame in

which these foods are used. The pouch also allows fun and aspirational graphics and images to be used on brightly coloured packaging, masking the realities of the often rather mundane contents.

In the 21st century, innovation in the baby food sector has seen a shift towards new product developments linked to changing global food preferences. Whilst products now have a greater emphasis on organic and healthy ingredients, the principle of offering sweet, soft commercial foods to babies before they are 6 months old remains, despite increasing public health advice to the contrary. Research has shown that infant feeding is seen as an important component of 'good mothering' in society, with the good mother identifying her baby's developmental needs and responding by purchasing appropriate consumer items (Afflerback et al, 2013). Manufacturers market foods for infants to meet these parental expectations, and they promote their products with messages related to safety, health, good taste and happiness to assuage parental fears of risk and fulfil the need to control an infant's health and well-being. Qualitative evidence from a survey by Maslin et al suggests that some mothers still see commercial foods as superior to and safer than home-made foods (Maslin et al, 2015). Mothers' choice of food in this survey was driven by 'taste', 'goodness' and 'the truth' (what was in the food and what was hidden). The researchers also highlighted differences in expert concerns about commercial baby food (that products have lower nutritional value, are sweet in taste, lack food diversity and the impact this may have on long-term food choice), and parental feelings that commercial foods are simple, safe and frequently superior to ones they might make themselves.

Advice on infant feeding also considers how infant feeding may impact on the development of allergic disease. Gut microbiota have an effect on the development of allergic disease and certain foods and nutrients may play a role in the prevention of allergic disease (some vitamins and minerals may be particularly important) with diverse diets of home-prepared foods linked to less allergic disease (Grimshaw et al, 2014).

With public health guidance increasingly linked to promoting home-prepared foods of greater texture and variety, it is timely to consider the commercial infant food market in the UK.

Thomas, 6 months, enjoying his first solid food.

Current infant feeding advice in the UK

Advice on infant feeding in the UK is provided by all four health departments, and is consistent across the country, mirroring the recommendations made in the *WHO Global Strategy for Infant and Young Child Feeding* (WHO, 2003). A new scientific summary to support policy around feeding infants in the first year in the UK will be published by the Scientific Advisory Committee on Nutrition in 2017, but it is unlikely to differ significantly from current global and national thinking.

Complementary feeding is the term given to the introduction of foods other than breastmilk (or infant formula) to an infant. We also use the term 'introducing solids'. In the UK it is recommended that the addition of foods other than milk starts at about 6 months of age. In the first six months of life, infants can get all the fluid and nutrients they need from breastmilk (or from correctly made up infant formula), and there is no need to introduce other foods before an infant's gut and swallow reflexes are fully ready. If parents or carers think an infant needs complementary foods before 6 months (26 weeks) of age, they should talk to a health visitor or other qualified health professional.

Infant development and readiness for foods other than milk

Every baby is different, but there are three clear signs which, together, show that a baby is ready for some solid foods alongside breastmilk or infant formula (NHS Choices, 2016). It is very rare for these signs to appear together before six months of age. The three signs of readiness for solids are:

- Baby can stay in a sitting position and hold their head steady.
- Baby can co-ordinate their eyes, hand and mouth so that they can look at the food, pick it up and put it in their mouth by themselves.
- Baby can swallow food. Babies who are not ready will push food back out of their mouth. However, if a baby is given a smooth, purée-type food, it is difficult to spit this out once in the mouth, so people may mistake involuntary swallowing of these foods with the ability to swallow food by choice.

People may mistake other signs as meaning that a baby needs solids. Research suggests that families often mistake baby waking in the night when they have previously slept through, the need for extra milk feeds, or signs such as chewing on their fist, as signs of readiness for solids (Brown and Rowan, 2015). These are just normal infant behaviours. Starting solid foods will not make a baby any more likely to sleep through the night (Brown and Harries, 2015), and extra feeds of milk are usually enough until the baby is developmentally ready for other food. Families often perceive baby boys to be 'hungrier' earlier than girls, or may mistake a baby that is bigger than its peers as needing food at a younger age (Brown and Rowan, 2015). However, developmental readiness for solids is the crucial factor, not the baby's size or gender. A recent Cochrane review of evidence on the timing of introduction of complementary foods confirmed no benefit to the introduction of solids before 6 months of age, and reiterated global recommendations for 6 months' exclusive breastfeeding (Smith and Becker, 2016).

What is the aim of introducing foods other than milk?

At about 6 months of age, most infants are developmentally ready for solid foods, and introducing solid foods is the start of the transition to a diet where solid foods provide the majority of energy and nutrients. It is important to introduce solids so that infants learn to chew and swallow a variety of textures and accept a range of tastes, and to add additional important nutrients to complement those from breastmilk (or infant formula) in the second six months of life, in particular iron (British Medical Association, 2013).

The aim of the complementary feeding period is to accustom infants to a range of flavours and foods so that, when they are in their second year and beyond, they can obtain the majority of their energy and nutrients from a range of healthy foods, preferably eaten with their families. Whilst breastmilk (or infant formula) will still provide the majority of energy and nutrients at 6-10 months, from about 10 months onwards infants should be transitioning to a diet where the majority of energy and nutrients is provided by food.

The start of complementary feeding is a sensitive period for the development of food preferences, particularly for those babies who have been formula-fed and who may have been accustomed to flavours not typically found in the family diet. Mothers who consume a good variety of foods get breastfed babies off to a good start, as flavours are transmitted from the maternal diet to breastmilk, and breastfed infants are more accepting of these flavours (Menella, 2014). We know that early experience with a variety of flavours and textures leads to more ready acceptance of new foods later in life (Harris and Coulthard, 2016), and it is generally accepted that, when a wide range of flavours are introduced, acceptance of a range of foods is more likely (Maier et al, 2007; Lange et al, 2013).

The eating patterns and food choices within a family will shape children's preferences and food acceptance patterns. Overweight tracks in families from parents to children (Kanciruk et al, 2014), and it is thought that this may be partly due to early patterns of exposure to foods and eating patterns. Evidence suggests that poor diet quality in infancy is related to greater adiposity at early school-age (Okubo et al, 2015). The social context of how children eat as infants is also important, because the eating behaviour of people around them serves as a model for a developing child, and we know that role models can have powerful effects on food selection.

Foods that should not be given in the first six months

If introducing complementary foods before 6 months of age, there are some particular foods that are recommended to be avoided (NHS Choices, 2016):

- foods containing wheat or gluten – such as bread, pasta or chapattis
- nuts and seeds – including peanuts, peanut butter and other nut spreads
- fish and shellfish
- eggs
- cows' milk.

These are all good foods to introduce after 6 months, but there is some concern that early introduction may be unwise when the gut may still be permeable to large protein molecules. There is no reason to restrict foods like gluten from 6 months of age even if there is a gluten intolerance in the family.

Further information about eating well in the first year of life and about how food and milk intakes may develop in the second six months can be found in the resource *Eating well: The first year*, available at www.firststepsnutrition.org. This resource also provides practical pictorial guidance on the types of solid foods that can be introduced to infants.

What do infants in the UK currently eat?

It has been reported that about half of parents whose youngest child is 6-12 months old used manufactured baby food in the UK in 2015, and this was more common among younger parents (Mintel, 2016). Encouragingly, this market research data also suggests that many UK families believe home-made baby food is the best option and do provide this for their child, although almost half of parents think commercial foods are a convenient option. The factors that are the most important to families buying commercial baby foods are that: the foods are a flavour they know their child likes; they are low in salt and sugar; they contain organic ingredients; and they count towards their child's '5 a day' (Mintel, 2016).

In the last 2010 UK-wide Infant Feeding Survey (McAndrew et al, 2012), it was reported that 58% of babies at 4-6 months and 84% at 8-10 months had been given commercial baby food. In the most recent Diet and Nutrition Survey of Infants and Young Children (Lennox et al, 2013), 72% of 4-9 month olds, 67% of 10-11 month olds, and 44% of 12-18 month olds ever ate commercially prepared baby food. Parents also reported that 36% of infants aged 4-6 months 'always' or 'almost always' ate a commercially prepared baby or toddler meal for the main meal of the day. This proportion steadily decreased with age so that, for those aged 12-18 months, only 5% 'always' or 'almost always' ate a commercially prepared baby or toddler meal for the main meal.

Table 1 summarises the reported data from the Diet and Nutrition Survey of Infants and Young Children on the use of commercial baby foods, by age group. Table 2 summarises the proportion of energy and nutrients that commercial baby foods are estimated to provide to the diets of infants and toddlers, by age.

It is interesting to note that, whilst commercial baby food provided around 15% of energy to the diets of infants 4-11 months of age in the last national survey, they provided between 25% and 44% of the aadded sugars (free sugars) in the diet (see Table 2).

Table 1: Reported intakes of commercial baby foods (by consumers) in the Diet and Nutrition Survey of Infants and Young Children

Commercial food type	4-6 months		7-9 months		10-11 months		12-18 months	
	g/day	% consumers	g/day	% consumers	g/day	% consumers	g/day	% consumers
Meat- and fish-based	72	52	87	61	95	53	83	29
Other savoury-based	43	34	50	36	59	32	46	13
Fruit-based	51	44	69	44	58	41	57	25
Dairy-based	43	25	50	19	50	14	50	6
Cereal-based	43	73	52	67	44	53	35	22
Snacks	7	34	6	62	6	60	6	42
Drinks	81	20	97	19	116	13	140	7

Source: https://www.gov.uk/government/publications/diet-and-nutrition-survey-of-infants-and-young-children-2011

Table 2: Reported contribution of commercial baby foods to energy and nutrient intakes by age group in the Diet and Nutrition Survey of Infants and Young Children

	Percentage of total energy or nutrients provided by commercial baby foods			
	4-6 months	7-9 months	10-11 months	12-18 months
Energy	16	17	14	6
Protein	19	20	15	5
Fat	8	10	8	4
Carbohydrates	20	21	17	8
Total sugars	13	15	12	6
Free sugars (non-milk extrinsic sugars)	44	34	25	11
Fibre	34	29	22	10
Vitamin A	23	25	23	12
Vitamin D	12	12	10	9
Folate	16	17	13	6
Iron	21	20	16	9
Zinc	15	16	13	6
Calcium	15	16	11	4
Sodium	16	15	10	3

Source: https://www.gov.uk/government/publications/diet-and-nutrition-survey-of-infants-and-young-children-2011

Regulations governing baby food composition

The current regulations for baby foods in England (and within similar legislation in Scotland, Wales and Northern Ireland) are the *Processed Cereal-based Foods and Baby Foods for Infants and Young Children (England) Regulations 2003*. These Regulations implement Commission Directive 2006/125/EC on processed cereal-based foods and baby foods for infants and young children (as amended). Regulations for the composition of baby foods were revised as part of the Foods for Special Groups legislation, which became law in member states from July 2016. However, in January 2016, the European Parliament rejected the revised compositional regulations for baby foods over concerns about the high sugar content allowed and pesticide residue limits. This work is now being reviewed and the European Food Safety Authority (EFSA) has been asked to review the labelling regulations relating to the age of introduction of solids to bring them into line with global infant feeding guidance as well as compositional issues for processed cereal-based foods. This work will report in 2018. In the meantime, the current regulations remain in place.

The Directive covers baby foods marketed to infants, and only products which comply with the Directive can be marketed in the EU. The regulations consider the use of specific ingredients and nutritional substances, maximum amounts of some nutrients, the pesticide levels permitted, restrictions on the presence of some substances, and labelling requirements. The full regulation can be accessed at http://eur-lex.europa.eu/legalcontent/EN/TXT/PDF/?uri=CELEX:32006L0125&from=EN

It is important to note that the regulations do not specify what the composition of baby foods should be; they just set a minimum or maximum amount for certain ingredients and nutrients. When manufacturers say they prepare products that are 'nutritionally balanced' in line with EU regulations, this has no real meaning. The specific compositional regulations of relevance are referenced in the appropriate sections of this report, and a summary of key points can be found in the Appendix.

Key issues

We have looked at 343 baby food products, in jars, pouches and trays, marketed for babies in the first year of life by the top four baby food manufacturers producing food of this type in the UK – Cow & Gate, Ella's Kitchen, Heinz and Hipp Organic – and have reviewed the products in light of key issues that have been raised in the scientific literature or public health documents relevant to infant nutrition. Data was collected from food labels and company websites. The data was collected between August and October 2016. We did not include smaller and own-brand baby food in the analysis, but a list of these brands can be found on page 19.

Questions relating to certain products and to information on labels and websites were sent to the four main manufacturers in summer 2015, and the responses were checked again with the companies in September 2016. We would like to thank the companies for their prompt and helpful responses.

This is a dynamic market and is constantly evolving, with new products and brands launched frequently, so this report provides a snapshot of the market in 2016.

The key issues covered in this section are:

- Age foods are marketed from
- Ingredients used in commercial baby foods
- Ingredients not recommended in the first six months of life
- Water as an added ingredient
- Portion size and energy content
- Vegetables and fruit
- Meat and fish
- Carbohydrates and sugars
- Protein
- Fat and fatty acids
- Salt
- Micronutrients
- Texture and thickeners
- Packaging, storage, safety warnings and usage instructions
- Cost of commercial baby foods
- Labelling and marketing

Age foods are marketed from

EU regulations allow foods to be marketed for infants from 4 months of age, and this was most recently reviewed as a safety issue by EFSA in 2009 (EFSA, 2009). However, global public health guidance recommends exclusive breastfeeding for the first six months of life so, whilst in labelling terms it may be legal to market foods as for use from 4 months, it is contradictory to other health guidance and policy in the UK. EFSA will be reviewing this as part of the revision of the delegated act on baby food composition (see page 16), and labelling regulations may change. In the interim, many brands are moving to labelling foods as for use from 6 months.

Manufacturers often also use 'stages' to describe different products, and this is left over from historical advice about 'the stages of weaning', which is no longer used. Current advice is that, if you start introducing solids at about 6 months, babies will move through different textures at their own pace, and it is infant development that should dictate this, not age.

A list of baby food brands marketed in the UK, with their current product labelling, is outlined in Table 3. This list may not be comprehensive as this is a dynamic market.

At the time of writing this report, all four main manufacturers of jars and pouches of baby foods – Heinz, Cow & Gate, Hipp Organic and Ella's Kitchen – market a range of foods as suitable from 4 months or for 4-6 months of age. Products for older infants are marketed as 6 months +, 7 months +, 8 months +, 9-12 months, and 12 months +. Throughout this report we have generally gathered products into three age groups:

- **4 months +**
- **6 months +**
- **9 months +**

It is currently recommended that infants should be introduced to complementary foods at about 6 months of age, regardless of the ages that baby food products are marketed for.

Almost half (45%) of all foods from these four main manufacturers marketed for infants in the first year are labelled as suitable for infants less than 6 months old. The Ella's Kitchen products marketed for 4 months + are all fruit and vegetable mixtures or sweet foods. Since we started this work, we have noticed that a number of products previously marketed for infants under 6 months of age have been withdrawn for that age group, perhaps reflecting companies taking note of public health advice on ingredients that should not be introduced under 6 months of age.

Summary

In the UK, the four biggest manufacturers of baby foods in jars and pouches market almost half of all their products for infants in the first year as being suitable for infants under the age of 6 months. This is despite public health guidance in the UK that complementary foods should be introduced at around 6 months of age. Many smaller manufacturers, as well as Asda and Marks & Spencer own-brand baby foods, and from 2017 the Organix brand, market their baby foods from 6 months of age, supporting global and national infant feeding guidelines.

All manufacturers should market baby foods as suitable from 6 months of age in line with public health guidance, to ensure that families receive consistent information about the appropriate age to introduce solid foods.

Table 3: Brands of baby food in the UK selling products for infants, and the ages the food is marketed for

Shaded items are those marketed as suitable for infants less than 6 months old.

Manufacturer and products	Ages and stages up to 12 months
Aldi 'Mamia' Organic purées and meals	(Stage 1) 4 months + (Stage 2) 7 months +
Annabel Karmel Organic baby and toddler purées and meals	(Stage 1) 4 months + (Stage 2) 7 months +
Asda 'Little Angels' Organic purées and meals	6 months + 7 months + 10 months +
Babease Organic meals for babies	(Stage 1) 4 months + (Stage 2) 7 months +
Bebivita	4 months + 7 months +
Boots 'Baby Organic' Organic purées and meals for babies and toddlers	4 months + 7 months +
Cow & Gate Purées, meals and snacks for babies and toddlers	4-6 months 7 months + 10 months +
Ella's Kitchen Organic purées, meals and snacks for babies and toddlers	4 months + 6 months + 7 months + 10 months +
For Aisha Halal and tayyab (pure) meals	7 months +
Goodness Gracious Baby purées based on organic and ayurvedic principles	4 months + 8 months +
Heinz Purées, meals, drinks and snacks for babies and toddlers	4-36 months (desserts) 4 months + 7 months + 10 months +
Hipp Organic Purées, meals and drinks for babies and toddlers	4 months + 6 months + 7 months + 9 months + 10 months +
Katy Elliott's Kitchen Frozen weaning and toddler meals	7 months +
Kiddie Cubes Frozen cubes of organic puréed and textured foods	(Stage 1) 4 months + (Stage 2) 7 months +
Kiddyum Frozen ready meals	(Stage 3) 10 months +
Lidl 'Lidl'uns' Organic fruit and vegetable purées	4 months +
Marks and Spencer 'Tiny Taste Buds' Organic purées and meals for babies and toddlers	(Stage 1) 6 months + (Stage 2) 7 month + (Stage 3) 10 months +
Organix Fruit pots, breakfasts and snacks	From March 2017, no products will be marketed for infants under 6 months of age.
Piccolo Smooth, organic meals	(Stage 1) 6 months + (Stage 2) 7 months +
Quinola Mothergrain Quinoa- and vegetable-based organic products	6 months +

Products included in this review

Figure 1 lists the product types included in the survey carried out for this report, and gives information about the age range that each product is marketed for.

Figure 1: Baby food product types included in this review

Below are details of the baby foods – packaged in jars, pouches and trays marketed for infants by the four main manufacturers – which we review in this report.

Manufacturer	Age	Number of products (% of each age group, by manufacturer)	Fruit and vegetables only	Savoury meat, fish and / or dairy based	Sweet dishes
Cow & Gate Total number of products **97**	4-6 months +	42 (26.9%)	20	10	12
	6 months +	35 (24.5%)		21	14
	9 months +	20 (45.5%)		20	
Ella's Kitchen Total number of products **75**	4 months +	29 (18.6%)	25		4
	6 months +	37 (25.9%)		27	10
	9 months +	9 (20.5%)		9	
Heinz Total number of products **69**	4 months +	44 (28.2%)	16	12	16
	6 months +	19 (13.3%)		19	
	9 months +	6 (13.6%)		6	
Hipp Organic Total number of products **102**	4 months +	41 (26.3%)	13	13	15
	6 months +	52 (36.4%)	3	32	17
	9 months +	9 (20.5%)		9	
Total number of products reviewed		**343**			

Ingredients used in commercial baby foods

Manufacturers are required by law to provide a list of ingredients, in the order of magnitude in which they are present, on the label of all foods. They are not required to say what amount of each ingredient there is, and manufacturers vary in how much information they provide. Ella's Kitchen specify the amounts of all ingredients present, while other brands provide some but not all amounts for ingredients present. All ingredients used in baby food must adhere to the same standards in terms of the amount of pesticide residues or other potential contaminants present.

Hipp Organic and Ella's Kitchen both use organically certified ingredients in their baby food. Their ingredients are certified within the EU, and products from both these manufacturers carry the EU 'leaf' logo.

Heinz and Cow & Gate do not use organically sourced ingredients, but use the term 'baby grade' to describe the ingredients they use. Cow & Gate use the term 'baby-grade vegetables' on their labels, but Heinz do not.

We asked both Cow & Gate and Heinz what 'baby-grade' means, and were given the following responses:

Cow & Gate: *"The term 'Baby grade' is an industry reference to requirements of the EC weaning foods legislation*[1]*, and the specific needs of very young children. We also use the term 'baby grade' to communicate our very strict and specific requirements on, for example, extra raw material traceability. For example, an organic vegetable grown to meet the pesticide requirements under organic legislation may not meet the stricter pesticide requirements for foods manufactured for young children under 36 months; the latter forms the basis for our definition of 'baby grade'."*

Heinz: *"Our internal baby grade standards for the ingredients we use are written in our ingredient specifications and controlled through our supply chain from field to product to ensure our products meet the strict legal requirements for infant foods.*

Unlike non-baby alternatives all our ingredients have to pass strict tests. EU regulations set stricter limits for contaminants in baby food vs non-baby food. This includes pesticides, mycotoxins, heavy metals, dioxins, veterinary medicine, acrylamide, nitrite, nitrates etc. For example, for pesticides, our controls ensure that our baby foods contain less than 10 microgram/kg, the legal requirement for infant and young children, which is far stricter than for non-infant foods where limits can be up to 200 times higher."

All baby food must meet the same EU regulations on composition, and the term 'baby-grade' has no legal meaning.

Summary

All baby food manufacturers must comply with regulations to ensure a low content of pesticide residues and other harmful contaminants in foods marketed to infants. Regardless of whether baby foods are made from organic or conventionally grown ingredients, these regulations are the same. The term 'baby grade' has no official meaning.

1 EU Directive 2006/125/EC and its amendments on Processed Cereal-based Foods and Baby Foods for Infants and Young Children

Ingredients not recommended in the first six months of life

Wheat or cereals containing gluten

Foods containing wheat or gluten should not be given to infants in the first six months of life (Start4Life, 2016). Gluten is a protein found in cereals such as wheat, rye and barley. By law, baby food labels must include a notification if they contain gluten. All manufacturers, except Heinz, have removed gluten from all foods marketed for infants under 6 months.

Two products in the Heinz 4 month + range contain gluten: there is durum wheat pasta in 'Cheesy tomato pasta' and wheat in 'Fruity apple and oat pudding'. We asked Heinz about the use of gluten-containing ingredients in their meals. Heinz said:

> *"With respect to gluten, in 2011, the Scientific Advisory Committee on Nutrition in the JOINT STATEMENT on Timing of introduction of gluten into the infant diet concluded that "currently available evidence on the timing of introduction of gluten into the infant diet and subsequent risk of coeliac disease and T1DM is insufficient to support recommendations about the appropriate timing of introduction of gluten into the infant diet beyond 3 completed months of age, for either the general population or high-risk sub-populations."*

Milk and dairy foods

In the first year of life, breastmilk or a first infant formula should be the main milk drink. Before the age of 6 months, cows' milk should not be used (NHS Choices, 2016). Cows' milk can, however, be mixed into foods and used in cooking for infants from 6 months of age onwards. Full-fat milk should always be used in recipes where milk forms a large proportion of the dish.

With the exception of Ella's Kitchen, all manufacturers in this review use milk, or products that contain milk such as yoghurt, milk powder and cheese, in some of their 4 month + meals. Cow & Gate produce two meals, marketed as suitable from 4 months, that contain milk products, Hipp Organic produce six, and Heinz produce 13. Both whole and skimmed milk are used in meals for infants aged from 4 months. See Table 4.

The manufacturers were asked about the milk used in their 4 month + products. Their replies were:

> Cow & Gate: *"We are aware of this [NHS Choices] advice and have reviewed our portfolio. As an outcome of this review we are in the process of changing the age recommendation on these types of meals – this is a process which takes some time to be reflected on shelf."*
>
> Hipp Organic: *"We are currently reviewing our situation with regards to cows' milk in our baby foods positioned from before 6 months, and considering whether cows' milk should be avoided before 6 months."*
>
> Heinz: *"For cow's milk there is general agreement that it shouldn't be given as a drink until one year of age. Nevertheless, as stated by the European Society for Pediatric Gastroenterology, Hepatology and Nutrition in its Medical Position Paper on complementary feeding, "it is acceptable to add small volumes of cow's milk to complementary foods"."*

Egg

Current recommendations are that egg should be avoided before 6 months of age (NHS Choices, 2016).

Heinz desserts are all marketed as suitable from 4 to 36 months and they currently produce egg custard, in two formats, which contains egg as an ingredient. Since we started this work, Cow & Gate have re-launched their egg custard, which was previously marketed as suitable from 4 months +, as now being suitable from 6 months +. Both products contain only 3% egg. None of the products from other manufacturers of foods for 4 months + included eggs.

We asked Heinz and Cow & Gate about the inclusion of eggs in meals for infants from 4 months +. Cow & Gate responded as for the milk question above:

> *"We are aware of this advice and have reviewed our portfolio. As an outcome of this review we are in the process of changing the age recommendation on these types of meals – this is a process which takes some time to be reflected on shelf."*

Cow & Gate have now completed this process.

Table 4: Example meals containing milk and milk products, marketed for infants aged from 4 months

Brand	Product name	Milk and milk products included in recipe
Cow & Gate	Cauliflower cheese	Skimmed milk and cheese
	Apples and baby rice	Whole milk powder
Heinz	Cheesy tomato pasta	Vegetarian Cheddar cheese
	Cauliflower broccoli cheese	Whole milk, vegetarian Cheddar cheese, butter
	Banana and chocolate pudding	Whole milk
	Fruity banana custard	Whole milk powder
	Fruit medley custard	Whole milk powder
	Fruity apple and pear custard	Whole milk powder
	Creamy rice pudding dessert	Whole milk
	Rice pudding	Whole milk
	Creamed porridge	Skimmed milk, cream
	Creamy oat porridge	Whole milk
	Chocolate pudding	Whole milk
	Egg custard with rice	Whole milk, skimmed milk
	Egg custard	Whole milk, skimmed milk
Hipp Organic	Cheesy spinach and potato bake	Skimmed milk, Cheddar cheese
	Tasty vegetable risotto	Skimmed milk, cream, skimmed milk powder, butter
	Banana yoghurt breakfast	Yoghurt
	Banana custard	Whole milk
	Creamy rice breakfast	Whole milk
	Rice pudding	Whole milk

Summary

A number of foods marketed to infants under 6 months of age contain ingredients that are not recommended in the diet before 6 months of age in the UK. Heinz, Cow & Gate and Hipp Organic include cows' milk or milk products in some of their savoury and sweet dishes marketed from 4 months. Only Heinz uses egg or gluten in foods marketed for infants under 6 months of age.

Water as an added ingredient

Water is added as an ingredient to many commercial baby foods sold in jars and pouches. The main purpose of adding water is to provide the right texture in the finished product or, where the food is cooked in the jar, to cook some ingredients present such as pasta or rice. The amounts of ingredients given on the label have to represent the cooked weight of each item. Meals based mainly on foods that already contain a high percentage of water, such as vegetables, should require less water to adapt their consistency than foods such as grains, lentils and meat where the water content may be lower. Where baby foods are packaged in a pouch and nozzle format, the texture must be loose enough for the product to be squeezed easily through the nozzle. The more water that is added as an ingredient, the less energy- and nutrient-dense the final product will become.

Ella's Kitchen states water on the ingredients list (as vegetable stock), which is included as an ingredient in the majority of their savoury meals for babies aged from 6 months. Vegetable stock regularly appears as the first or second ingredient by volume in the list of ingredients. The percentage of vegetable stock is, however, always stated and, where present, can be up to 52% of the product volume. When asked to comment on the water content of their products, Ella's Kitchen pointed out that their labelling has been agreed with Trading Standards and that:

> *"Ella's Kitchen is the only brand to openly label the percentage of every ingredient in a recipe. In doing so, consumers can determine for themselves whether to buy the product knowing the full ingredient list and percentage."*

and

> *" ... we add water in the same way that a homemade recipe would call for stock or cooking water. When making homemade purées or mashed meals for little ones, it would still be necessary to add water or baby's usual milk to achieve a safe and suitable texture."*

Cow & Gate include 'water for cooking' or just 'water' on their ingredients lists and sometimes include the amount used.

Hipp Organic includes water as an ingredient and the amount is sometimes given.

Heinz products sometimes list the amount of water. We asked Heinz why the water content of their meals was not consistently labelled. They replied:

> *"The ingredients list is written according to legislation. Water is added to cook dry ingredients such as rice, pasta and lentils. Also, water is needed to make food the right consistency for the stage of development of the infant who will eat it and to ensure the product meets the nutritional requirements laid down in legislation."*

Table 5 shows some stated and estimated water contents of baby foods. Ella's Kitchen should be commended for including detailed ingredient amounts on all their labels. None of the Ella's Kitchen desserts have water added, as would be expected in dishes made from milk, yoghurt and fruit. Surprisingly, some desserts and breakfasts made from these ingredients from other manufacturers still include water. The use of thickeners such as rice starch mean that manufacturers can dilute ingredients and include a greater proportion of water.

Table 5: Examples of baby foods and stated or estimated water content

Brand	Food name	Age marketed for	Water or stock % stated on label	Is water or stock the first ingredient?	Estimated or known water content * (See note on next page.)
Ella's Kitchen	Bangers and mash with veggies	6 months +	✓	✓	52%
Ella's Kitchen	Mexican chicken with rice and peppers	6 months +	✓	✓	52%
Ella's Kitchen	Jamaican curried pork with rice and peas	6 months +	✓	✓	48%
Ella's Kitchen	Salmon risotto with cheese	10 months +	✓	✓	47%
Cow & Gate	Banana crumble	6 months +	✗	✓	45%
Ella's Kitchen	Cauliflower cheese with butter beans	6 months +	✓	✓	44%
Ella's Kitchen	Macaroni cheese with basil	6 months +	✓	✓	41%
Hipp Organic	Creamed porridge breakfast	7 months +	✗	✗	40%
Heinz	Vegetable and chicken hotpot	10 months +	✗	✓	39%
Ella's Kitchen	Thai curry with noodles and coconut	10 months +	✓	✓	38%
Cow & Gate	Sweet potato and beef meal	4 months +	✗	✓	38%
Heinz	Lamb and winter vegetables	6 months +	✗	✓	36%
Cow & Gate	Cauliflower and turkey pie	9 months +	✗	✗	32%
Hipp Organic	Parsnip, potato and turkey casserole	6 months +	✗	✗	31%
Hipp Organic	Sweetcorn peppers and chicken risotto	10 months +	✗	✗	30%
Hipp Organic	Hearty vegetable pork and apple casserole	6 months +	✗	✓	28%
Cow & Gate	Delicious peach and apple	4 months +	✗	✗	27%
Hipp Organic	Rice pudding with apple and pear	6 months +	✗	✗	27%
Hipp Organic	Fruit layer mango and banana topped with yoghurt	6 months +	✗	✗	26%
Heinz	Creamed porridge multi-pack	4 months +	✗	✗	26%
Cow & Gate	Rice pudding (multi-pack)	4 months +	✗	✗	25%
Cow & Gate	Fruity banana yoghurt	4 months +	✗	✗	23%
Heinz	Chocolate pudding (multi-pack)	4 months +	✗	✘	14%

* In Table 5, the data for Ella's Kitchen products is taken from the labels. For other foods it has been estimated from information provided about other ingredients. In many cases manufacturers provide insufficient information on their labels for this to be estimated accurately, but we have based our estimate on the order of ingredients and information that is present. We are happy to amend this if information is provided to the contrary.

Summary

The water content of baby foods is not included on many baby food labels. Ella's Kitchen is the only company to consistently provide information on the amounts of all ingredients present, including water.

The water content of many commercial baby foods is, however, greater than is likely to be present in home-made food, and this means that the energy density of the food is likely to be lower. A baby would therefore need to eat a high volume of most commercial baby food to obtain the energy and nutrients needed.

Portion size and energy content

The portion sizes of baby foods are highly variable. Table 6 summarises the portion sizes of different ranges within the four main brands. Jars are much bigger than pouches in all ranges.

Table 6: Weights of different brands and food types marketed by age

Brand	Age marketed from	Type of food and packaging	Weight
Cow & Gate	4 months +	'Friends' pouches	50g
	4 months +	Fruit and vegetable pouches	80g
	4 months +	Fruit pots	100g
	4-6 months	Savoury meal jar	125g
	6 months +	Savoury meal pouch	100g
	7 months +	Savoury meal jar	200g
	7 months +	Savoury meal pouch	130g
	10 months +	Savoury meal jar	250g
	10 months +	Savoury meal pouch	190g
	10 months +	Savoury tray meal	230g
Ella's Kitchen	4 months +	Single variety fruits and vegetables pouch	70g
	4 months +	Mixed fruit vegetable meal pouch	120g
	6 months +	Savoury meal pouch	120g
	7 months +	Savoury meal pouch	130g
	10 months +	Savoury meal pouch	190g
Heinz	4 months +	Fruit and vegetable jars	125g
	4 months +	Fruit and vegetable pouches	100g
	4 months +	Savoury meal jar	120g
	4 months +	Savoury meal pouch	100g
	7 months +	Savoury meal jar	200g
	7 months +	Savoury meal pouch	130g
	10 months +	Savoury meal pouch	180g
Hipp Organic	4 months +	Fruit or vegetable jars	125g
	4 months +	Fruit pouches	100g
	4 months +	Fruit pots	100g
	4 months +	Savoury meal jar	125g
	4 months +	Savoury meal pouch	100g
	6 months +	Savoury meal jar	125g
	6 months +	Dessert jar	125g
	6 months +	Dessert pouch	120g
	7 months +	Savoury meal jar	200g
	7 months +	Savoury meal pouch	130g
	7 months +	Dessert jar	160-190g
	9 months +	Savoury tray meal	230g
	9 months +	Savoury jar	220g

On the Heinz website it suggests that infants at 7 months will eat about 150g of food at a meal, but it is not clear how this is calculated or how it relates to the size of products they sell. Meals sold in jars and pouches will both be assumed to be a portion for a baby, despite being very different weights.

As there are such large variations in the weight of foods offered by age at which the products are marketed, it is useful to observe whether the energy density of foods across ranges is similar, or whether the energy offered by a portion is similar in a jar or a pouch.

Where foods are marketed as first tastes or from 4 months of age, it cannot be presumed that the whole jar or pouch is a portion, and therefore we have not considered these in the average energy values or energy densities for a meal.

We have looked at those foods marketed as a whole meal from 6 months onwards. In our publication *Eating well: The first year*, we considered the eating patterns and nutritional requirements of infants at 7-9 months and 10-12 months. We calculated these based on intakes of breastmilk (or infant formula) of about 600ml/day at 7-9 months, and 400ml/day at 10-12 months. Table 7 estimates the energy content required in meals to meet daily energy requirements alongside the breastmilk (or infant formula) that an infant is likely to receive. These are just average figures, but provide an estimate against which to compare the energy provided by commercial baby foods.

The relatively modest energy requirements of infants mean that meals must be energy- and nutrient-dense. In the example meals that we show in our resource *Eating well: The first year*, most meals have an energy content of about 0.80-1kcal/1g, and portion sizes are around 100g for infants aged 7-9 months and 100-140g for infants aged 10-12 months. As a comparison, breastmilk provides about 0.69kcal/g.

The energy density of most commercial foods is lower than the 0.8-1kcal/g that we believe provides infants with dishes of sufficient energy and nutrient density to suit small appetites. See Table 8. Many commercial foods have a lower energy density than breastmilk. Desserts are generally the highest energy density foods as these have less water added because the ingredients are generally already soft and smooth. The water added to many commercial foods means that the energy density is lower.

Other research has reported that typically vegetable- and meat-based baby food meals had an average energy density of 0.68kcal/g, with fish dishes slightly higher at 0.83kcal/g (Carstairs et al, 2015).

Table 7: Estimated energy needs of infants at meals to complement nutrients in breastmilk (or infant formula)

Meal	Energy contribution of meals to infant of 7-9 months (Total energy requirement from food = about 250kcal)	Energy contribution of meals to infant of 10-12 months (Total energy requirement from food = about 450kcal)
Breakfast	85kcal	100kcal
Lunch – savoury meal	85kcal	100kcal
Lunch – dessert	–	75kcal
Tea – savoury meal	85kcal	100kcal
Tea – dessert	–	75kcal

Table 8: **Ranges of energy per portion, and energy density, in commercial baby foods**

Brand	Age marketed from	Product type	Range of energy in kcal/portion	Energy density in kcal/g
Cow & Gate	6 months +	Savoury meals in pouches	41-55	0.41-0.55
	6 months +	Desserts in jars	89-111	0.71-0.81
	7 months +	Savoury meals in jars	124-152	0.62-0.76
	7 months +	Savoury meals in pouches	77-86	0.59-0.66
	7 months +	Desserts in jars	102-178	0.51-0.89
	10 months +	Savoury meals in jars	114-188	0.46-0.75
	10 months +	Savoury meals in pouches	114-163	0.60-0.86
	10 months +	Savoury tray meals	145-186	0.63-0.8
Ella's Kitchen	6 months +	Savoury meals in pouches	54-104	0.45-0.87
	6 months +	Desserts in pouches	79-84	0.88-0.93
	7 months +	Savoury meals in pouches	56-105	0.43- 0.81
	7 months +	Desserts in pots	64-70	0.8-0.88
	9 months +	Savoury meals in pouches	95-148	0.5-0.78
Heinz	4-36 months	Desserts in jars	82-100	0.68-0.83
	4-36 months	Desserts in pots	50-86	0.5-0.86
	7 months +	Savoury meals in jars	114-154	0.57-0.77
	7 months +	Savoury meals in pouches	72-111	0.55-0.85
	10 months +	Savoury meals in pouches	97-128	0.54-0.71
Hipp Organic	6 months +	Savoury meals in jars	76-108	0.61-0.86
	6 months +	Desserts in jars	93-95	0.74-0.76
	6 months +	Desserts in pouches	65-69	0.65-0.69
	7 months +	Savoury meals in jars	122-163	0.64-0.86
	7 months +	Desserts in jars	120-220	0.75-1.16
	7 months +	Savoury meals in pouches	87-100	0.67-0.77
	9 months +	Savoury tray meals	166-207	0.72-0.9
	9 months +	Savoury meals in jars	165-196	0.75-0.89

Why does energy density matter?

Babies have relatively small stomachs and therefore require energy- and nutrient-dense foods to complement breastmilk (or infant formula) from 6 months of age. The aim of complementary feeding is to add more nutrients and energy to the diet. Breastmilk provides about 0.69kcal/g, and complementary foods should offer more than this alongside other nutrients. Babies may not be able to manage large portions of wetter foods and may therefore not obtain all the nutrients needed. There may also be considerable waste.

Are the portion sizes and amounts of energy offered in commercial baby meals realistic?

Table 9 considers how many commercially produced meals exceed the estimated amounts of energy needed by an infant 7-9 months or 10-12 months of age, and the range of energy contents these commercial meals provided.

It should be noted that those baby food manufacturers who also market infant formula recommend a higher intake of formula milk than used in our calculations. Danone, who make Cow & Gate foods and milks, recommend that babies aged 7-12 months have 600ml of formula a day, and Hipp Organic, who make Hipp Organic Combiotic formula, recommend 500-600ml. Heinz told us they estimate meals for 10-12 month olds based around 500ml milk a day. A higher milk intake would allow even fewer calories for food than we have estimated.

Table 9: How the energy content of commercial foods compares with the estimated energy required in infant meals

Age of infant and type of meal	**Estimated energy requirement of meal** (kcal)	**Percentage of meals marketed for that age group that exceed estimated energy requirement**	**Range of energy provided by baby foods in that category** (kcal/portion)
7-9 months Savoury meal	85	61%	41-163
7-9 months Dessert	*Desserts are not introduced in our menu plans until 10 months of age.*	–	50-220
10-12 months Savoury meal	100	86%	95-207
10-12 months Dessert*	75	90%	50-220

* Marketed for 6 months +, 7 months +, and for 4-36 months, depending on the range. Averages based on 49 commercial desserts.

We asked manufacturers to explain how they assessed products to be 'nutritionally balanced' and how they calculated an appropriate portion size for foods at different stages. Cow & Gate replied:

"We are not able to calculate specific portion sizes for our foods as babies appetites will vary considerably between the ages of 7 to 12 months. The WHO report on complementary feeding suggests that the energy requirements of infants between 6-8 months are 200kcal from complementary foods and from 9-11 months are 300kcal from complementary foods. There is a technological challenge with reducing the energy content of some meals, whilst maintaining the standards for protein and fat, especially when using ingredients that are naturally much higher in calories e.g. cheese."

If Cow & Gate are using WHO energy values as a guide, alongside the amount of milk they also recommend, it is not clear how the foods they produce would fit into a menu plan for infants with such low energy needs.

Heinz responded that:

"When looking at the nutritional profile of products, we need to tailor the energy content with the nutritional and regulatory requirements and with a reasonable serving size which ensure an adequate energy density of each meal ensuring it is in line with the Infant guidelines EU Directive 2006/125/EC on processed cereal-based foods and baby foods for infants and young children."

However, EU regulation does not require products to have a specific energy content or specific amounts of fat, protein and carbohydrate.

Summary

The energy content of commercial baby food portions is highly variable across products. The energy density is also variable, and many commercial foods have a low energy density, with few achieving the 0.8-1kcal/g that provides energy- and nutrient-dense meals for small appetites.

The portion sizes of many commercial baby foods exceed our estimated energy requirements at meals, and where infants are consuming savoury and dessert foods under 10 months of age they are very likely to exceed daily energy needs. Almost all main meal savoury meals and desserts for infants aged 10-12 months exceeded our estimates of energy requirements for that age group.

Despite the lower energy density of commercial baby foods, the portion sizes are sometimes large. Some manufacturers claim that meals are 'nutritionally balanced', but how they calculate this or what it relates to is unknown.

Vegetables and fruit

Vegetables and fruit are the most commonly used ingredients in commercial baby foods. Many of the foods marketed for 4 months + are single fruit or vegetables, or combinations of them (up to four in a combination), and just over 22% of all foods marketed in jars and pouches are based on fruits and vegetables alone. The use of fruits and vegetables as first complementary foods has been recommended for many decades, and all public health advice encourages these foods (along with a range of other foods such as meat, fish, eggs, pulses, dairy products and cereals) from 6 months of age. Recommendations also promote the importance of encouraging infants to enjoy a wide variety of these foods. However, one of the reasons why many commercial baby foods use a high proportion of fruits and vegetables is to provide colour, sweet flavours and soft texture.

Baby food offers a predominance of sweet flavours

A number of studies have reported on the high proportion of sweet-tasting baby foods marketed.

Garcia et al (2013) collected nutritional information from infant foods available on the UK market in 2010/2011 from Cow & Gate, Heinz, Hipp Organic, Ella's Kitchen, Boots and Organix. Of the 479 foods collected, they found that 364 (76%) were ready-made spoonable foods. Just under a half (223) of foods in the study were sweet foods, with 80% including fruit in the name. Around a third of these sweet products were a fruit-only sweet food, but for the rest of the sweet fruit products the amount of fruit included was not clearly stated. Around a half of fruit-based foods (44%) were aimed at infants from 4 months of age, and almost two-thirds (65%) of foods aimed at this age group were sweet foods.

A further study by Garcia et al (2015) reported that a large proportion of UK commercial baby food was sweetened with fruit or sweet-tasting vegetables. Fruit, and sweet vegetables such as carrots, were used predominantly in 329 manufactured baby foods available in the UK, with bitter vegetables such as spinach or broccoli used much less frequently. The authors suggest that there is commercial pressure to produce instantly palatable foods, which dissuades manufacturers from using more bitter vegetable flavours.

Dunford et al (2015) found a similar predominance of fruit-based sweetened food available in Australia. In a survey of 186 manufactured baby foods in Canada (Elliott, 2011), a large proportion of foods contained more than 20% of their calories from sugar, both from derived fruit and as added sugars (for example, corn syrup, brown sugar or dextrose). Further work by Elliott and Conlon (2014) on the sugars content of baby food reported that babies are "immersed in a sweeter foodscape than any previous generation", with 45% of foods in their study having a high sugar profile. A report on baby food in the US by the Rudd Center for Food Policy and Obesity considered fruit and vegetable baby foods as having a high nutrition index, even if these were sweet foods (Rudd Center for Food Policy and Obesity, 2016). However, they used the 2007 UK methodology for determining nutrient profiles, which allowed fruit purées to be included in the definition of fruit and vegetables, and did not classify the sugars in these foods as free sugars.

Single fruit and vegetable meals or tastes

Of the 77 fruit-only and vegetable-only meals reviewed for this report, 19 (25%) were single fruit or vegetable preparations. Single fruit or vegetable varieties are generally marketed as being suitable for the first stage of complementary feeding. Ella's Kitchen produce 10 single fruit or vegetable meals, Cow & Gate produce 6 and Hipp Organic produce 3. Heinz do not produce meals based on a single fruit or vegetable. All of the fruit-based single-fruit meals contained 100% fruit. Some Cow & Gate, Heinz and Hipp Organic products have vitamin C (ascorbic acid) added. Ella's Kitchen and Heinz add very small amounts of lemon juice to some of their meals. As vegetable-based meals must be cooked prior to being puréed, they may also contain water. Where stated, the amount of water in final products varies between 18% and 50%.

First tastes: Do commercial single-flavour fruits and vegetables support current complementary feeding guidance?

The foundations for later food preferences are established by early food exposure. Introducing babies to single foods, and repeated exposure to the same food, have been shown to favour acceptance (Birch et al, 1998). The importance of introducing a range of flavours early is particularly important when infants have been given formula milk, which lacks the diverse flavour profiles in breastmilk (Gerrish and Mennella, 2001). Liking for vegetables is thought to be linked to serving individual unmixed vegetables to infants, rather than hiding savoury and bitter flavours in sweeter foods (Remy et al, 2013). A 'vegetables first' approach is now thought to promote vegetable liking in infants (Barends et al, 2013; Fildes et al, 2015). Children will accept and like vegetable tastes if exposed to them repeatedly, but Garcia et al (2015) conclude that feeding commercial vegetable-based purées will not help children develop a taste for vegetables as the taste of processed foods is dissimilar to home-prepared foods, so families should be encouraged to cook and offer home-prepared vegetables.

Cow & Gate launched a range of single fruit and vegetable purées in 2014 as 'Cow & Gate Friends'. The original range was marketed in boxes containing four different 50g pouches of fruit, or four different vegetable varieties (broccoli, carrots, cauliflower and peas). By 2016, none of the vegetable pouches were still being marketed, but the fruit 'Friends' remain.

As has been noted by Garcia et al (2015), manufacturers are under commercial pressure to produce instantly palatable foods, and therefore sweet foods are likely to make up a large proportion of their offer. When infants reject foods, this can mean commercial foods are wasted.

In 2016 Ella's Kitchen launched a 'Veg for Victory' campaign. To support this campaign, they use a review, funded by them, from the British Nutrition Foundation (Chambers, 2016), and highlight the need for vegetable flavours when first introducing solids, stating in their own *Greener Paper* on their website that:

"Sweeter vegetables such as carrot or sweet potato are typically easier to introduce to infants, as the flavour profile is closer to that of fruit. In order to develop healthier relationships with vegetables, the roundtable participants recommended that mums, dads and carers should try introducing a 'rainbow' of vegetables, prioritising less sweet flavours e.g. cauliflower and broccoli to add variety to the diet."

The single vegetable and fruit range from Ella's Kitchen, however, contains 10 flavours, 6 of which are sweet (banana, prune, mango, apple, pear and peach), and 4 of which are sweet vegetables (sweet potato, carrot, parsnip and peas). It is interesting to note that, despite the evidence they are using in their campaign, foods such as cauliflower and broccoli are not included in their range. Also, these 70g pouches are not always 100% fruit or vegetables; depending on the ease with which foods can be puréed, they have water added. For example, the puréed peas are only 50% peas. Ella's Kitchen's range of mixed vegetable dishes also has predominantly sweet tastes, dominated by apple and pear purée (see page 36).

The advantages of preparing home-made vegetables

We do not believe that there is any need for manufacturers to produce simple mashed fruit or vegetables as families can easily, and cheaply, prepare these themselves. The key advantages of preparing your own vegetable tastes are:

- **They will have less added sugars.** Highly processed fruit and vegetable purées are high in added sugars, since the sugars have been fully liberated from the cell walls. Preparing your own simple mashed fruits and vegetables will not concentrate the sugars in the same way.
- **The taste and colour will be authentic.** Many of the highly processed vegetables in pouches have a taste and colour dissimilar to fresh products, and lack natural variation in flavour.
- **The cost will be much lower.** If you mash your own organic carrots, 70g would cost 14p, while 70g of Ella's Kitchen 'Carrots carrots carrots' (which are 82% carrots), costs 90p.
- **The consistency of the food can be prepared to suit an infant's needs.** Many babies at 6 months are able to have thicker smooth foods or mashed foods on a spoon, and should be offered soft finger foods such as cooked carrot sticks.
- **The amount of a vegetable you need at each occasion can be prepared and offered and this will minimise waste**, and reduce the need to store opened packets of food safely.
- **A baby can eat the same foods as the rest of the family** and learn to recognise the smell, sight and taste of family foods.
- **Packaging waste is minimal.** Baby food pouches are environmentally resource intensive and non-recyclable.

Combinations of fruits and vegetables

In our sample of 77 fruit-and vegetable-based commercial baby foods, 23 (30%) are based on two different fruits or vegetables, 29 (38%) are based on three types, and 6 (8%) are based on four different fruits and vegetables. All those based on two different fruits or vegetables contained either two fruits or two vegetables. Where meals were based on three or four different fruits or vegetables, some unusual combinations of both fruits and vegetables were used. For example, 'Broccoli, pears and peas' and 'Spinach, apple and swede' by Ella's Kitchen, and 'Pumpkin, sweet potato and apricot' by Heinz. Cow & Gate and Hipp Organic do not produce fruit and vegetable only meals where fruits and vegetables are combined in the same meal. Combining flavours in this way makes it difficult for children to recognise the colour, texture and flavour of single vegetables or fruit, and may reduce the likelihood that these flavours will be recognised and accepted by children when offered alone in family meals.

Many of these combinations, as well as being ones which a family would be unlikely to put together themselves, are also predominantly apple-based (or pear-based). Across all of the fruit-only meals, 75% (40) had apples or pears as the main ingredient, and of these 30% (12) did not feature apples or pears as the leading named ingredient. Also, four of these products failed to mention apple or pear anywhere in the product name, and two were generically named as 'fruit mix' or 'fruit cocktail'. The proportion of meals combining fruit with vegetables that had apples or pears as the main ingredient was 70%, and none of these had apple or pear as the leading named ingredient.

There may be a number of reasons for using a high proportion of apple and pear in baby foods: apples and pears are easy to source; they help to bulk out products where other ingredients are more expensive; they offer a sweet taste which may encourage acceptance in infants; and they are easy to make into smooth purées in processing.

Garcia et al (2013; 2015) reported that many of the fruit and vegetable purées intended as first tastes and first foods are sweet, and use combinations of fruits and vegetables to mask bitter flavours and individual flavours. Eighteen per cent of baby foods in their study contained added fruit juice, and frequently three or more different fruits and vegetables in a purée were used, which, as they point out, is not ideal for flavour learning. The authors suggest that there is a risk that parents will think they are offering healthy vegetable tastes to their children, but are instead reinforcing preferences for sweet tastes. Whilst it has been argued that mixing sweet flavours with vegetables would increase acceptance, work by Remy et al (2013) found that repeated exposure to a novel vegetable was not improved by adding a sweet component.

Do the names of fruit and vegetable mixtures reflect the ingredients present?

Cow & Gate fruit and vegetable dishes, as well as many smaller brands, predominantly name their products in line with the ingredients present. Some examples of potentially misleading combinations from other manufacturers are given in Table 10.

2 Based on organic carrots bought from Tesco in October 2016 (£1 for 700g; equivalent to 490g prepared weight).

Table 10: Baby food fruit and vegetable combinations with names that do not reflect the main ingredient

Brand	Age range	Name	Ingredients
Ella's Kitchen	4 months +	Blueberries, apple, banana and vanilla	**Organic apples (52%)**, organic bananas (36%), organic blueberries (11%), organic vanilla extract (1%), a dash of organic lemon juice concentrate
	4 months +	Broccoli, pear and peas	**Pears (79%)**, peas (14%), broccoli (7%), lemon juice concentrate
	4 months +	Butternut squash, carrots, apples and prunes	**Apples (39%)**, carrots (25%), butternut squash (20%), prunes (16%), lemon juice
	4 months +	Carrots, apples and parsnips	**Apples (68%)**, carrots (22%), parsnips (10%), lemon juice
	4 months +	Mangoes, pears and papayas	**Organic pears (78%)**, organic papayas (11%), organic mangoes (11%), a dash of organic lemon juice concentrate
	4 months +	Red peppers, sweet potatoes and apples	**Apples (78%)**, red peppers (11%), sweet potatoes (11%), lemon juice from concentrate
	4 months +	Spinach, apples and swedes	**Apples (55%)**, spinach (34%), swedes (11%), lemon juice from concentrate
	4 months +	Sweet potato, apple, pumpkin and blueberries	**Apples (52%)**, sweet potatoes (23%), pumpkin (20%), blueberries (5%), lemon juice from concentrate
Heinz	4 months +	Sweet red pepper, tomato and carrot	**Carrot 40%, sweet potato 32%**, tomato 17%, red pepper 17%, water, iron sulphate
	4-36 months	Peach, mango and banana purée	Fruit (100%), concentrated **apple purée (50%)**, peach (25%), mango (15%), banana (10%), concentrated lemon juice, vitamin C
	4-36 months	Strawberry, raspberry and banana purée	Fruit (100%), concentrated **apple purée (79%)**, strawberries (8%), banana (8%), raspberries (5%), concentrated lemon juice, vitamin C
	4-36 months	Blueberry and banana purée	Fruit (100%), concentrated **apple purée (78%)**, banana (12%), blueberries (10%), concentrated lemon juice, vitamin C
	4-36 months	Mango, banana and lime purée	Fruit (100%), concentrated **apple purée (63%)**, mango (20%), banana (13%), lime juice from concentrate (4%), vitamin C
Hipp Organic	4 months +	Mango, apple and peach	Fruits* (100%) [**apple (60%)**, mango* (25%), peach* (15%)], antioxidant ascorbic acid * Organic
	4 months +	Peach, apple, blueberry and raspberry	Fruits (100%) [**apple* (73%)**, peach* (16%), blueberry* (6%), raspberry* (5%)], antioxidant ascorbic acid * Organic

Whilst this report focuses on the four main brands of baby food, some of the smaller, more expensive brands use the same techniques when naming products. For example, Piccolo 'Spring greens with a hint of mint' is 70% apples and pears; Piccolo 'Squash, red pepper and chickpea' is 49% apple; and Piccolo 'Banana, blueberry and apple' is 51% apple.

When asked how the naming of products relates to the ingredients present, Ella's Kitchen responded:

> *"[our] naming convention reflects the order of taste dominance. For example, the dominant taste of Berry Yummy Yoghurt is blackcurrants and blueberries owing to their strong taste. The same goes for Cauliflower Cheese: cauliflower and cheese are the lead tastes."*

Hipp Organic replied that:

> *"The naming of HiPP Organic baby foods highlights the key ingredients in the product and those that most influence the taste of the product."*

We have tasted a range of baby foods whilst doing this project and 'the dominant flavour' hypothesis was not apparent to us. It would be useful to do formal taste panel work in this area to verify this. In 2015 the US charity the Center for Science in the Public Interest (CSPI) threatened to sue Plum Organics and Gerber for misrepresenting the content of baby foods (CSPI, 2015). CSPI claimed that cheaper and sometimes less nutritious foods, juices and water were being used instead of the ingredients highlighted in the product names.

Predominance of carrot and sweet vegetables in savoury dishes

A survey of German baby foods reported that the range of vegetables typically used in savoury baby meals was limited, with a high proportion of carrot used in many foods (Mesch et al, 2014). In our survey, carrot was the vegetable used in the highest amount in 46% of meals marketed at 4 months +, 36% of meals marketed for 6 months + and 34% of meals marketed for 9 months+.

Many other meals had, as the predominant vegetables, tomato, parsnip, sweet potato, pumpkin, butternut squash or sweetcorn in combination with carrot, giving the majority of savoury baby foods a sweet and soft texture. Overall the number of foods which had a more bitter vegetable as the main vegetable ingredient was limited to dishes such as cauliflower cheese or courgette and broccoli pasta dishes. Cauliflower, broccoli, spinach, cabbage or courgette was the main vegetable present in 11% of meals marketed for infants 4 months +, 13% of meals marketed at 6 months +, and 16% of meals marketed at 9 months +. In almost all dishes, however, sweet vegetables were also added in amounts that would sweeten the taste. Overall only 3 meals (9%) marketed at 4 months +, 9 meals (9%) marketed at 6 months + and 4 meals (9%) marketed at 9 months + had cauliflower, courgette or broccoli not combined with sweet vegetable flavours.

Vegetable and fruit portions

Current guidance on the amount of fruit and vegetables that should be included in the diet suggests that, from 1 to 4 years, children should have five different types a day, with portions of about 40g (see our resource *Eating well: Good food choices and portion sizes for 1-4 year olds*). There are no specific national guidelines for infants on what constitutes a 'portion'.

Some manufacturers choose to make claims on the product packaging around the quantity of fruits and vegetables in their baby foods. Different manufacturers use different methods of describing the fruit and vegetable content of their meals and may not always use the same method on all of their products. As a consequence, it may be difficult for consumers to make informed decisions when choosing food for their baby.

Ella's Kitchen do not make claims for the portions of fruit or vegetables on their foods.

Cow & Gate describe the vegetable content of their steamed tray meals for children aged 10 months + in terms of containing, for example, '4 different vegetables' or '6 different vegetables'. It is possible that consumers confuse the number of different vegetables in a food with the number of portions of vegetables.

When asked about how the vegetable and fruit portion sizes and claims were calculated, Cow & Gate said:

> *"We acknowledge that only small amounts of some vegetables may be used and we are not making the claim that each vegetable variety constitutes a portion. This statement indicates the total number of vegetables included within the product, irrespective of the amount used."*

Heinz pouches and jars at 4 months +, 7 months +, and 10 months + claim to provide one or two portions of 'your baby's 5-a-day'. When asked about how the fruit and vegetable portion sizes and claims were calculated, Heinz said:

> *"One portion of a baby's '5 a day' is 40g. Where our recipes contain this, we highlight this on the label."*

Hipp Organic also make portion claims on some of the products in their 4 months +, 6 months +, and 9 months + product ranges. Hipp Organic's website says portions are calculated based on these amounts:

- at stage 1 (around 6 months) one portion = 30g
- at stage 2 (from 7 months) one portion = 35g
- at stage 3 (from 10 months) one portion = 40g.

Claims based on the number of portions of fruits and vegetables in a meal are not the same as claims relating to the UK government's 5-A-Day campaign. If a claim is made simply for the number of portions of fruit or vegetables in a meal, this could be calculated by dividing the total weight of vegetables in the meal by the stated portion size. However, if reference is made to the UK government's 5-A-Day campaign, the calculation should be more complex, as further criteria must be considered to ensure that the recommendation to eat different fruits and vegetables is included. In order to promote a consistent approach across manufacturers, the Institute of Grocery Distributors (IGD) provides best-practice guidance to industry on how to calculate and communicate the number of fruit and vegetable portions in composite meals (IGD, 2014). The differences between claims made by manufacturers, and the absence of complete information on the quantity of each ingredient on some product labels, make it difficult to establish if this guidance has been followed.

Summary

There is a predominance of sweet baby foods on the market, and many of these use fruit and vegetables to provide sweet flavours, even when the dish appears to be a savoury option.

Single-flavour first fruit and vegetable purées are expensive and high in sugars, and lack the authentic taste and texture of simple home-made versions.

There is no evidence that mixing sweet flavours with vegetables helps infants to accept vegetable flavours, but manufacturers provide few simple vegetable tastes.

When fruits and vegetables are combined, the name often does not reflect the main ingredient, and many have a very high proportion of puréed apple or pear, even when this is not highlighted in the name.

The main vegetable used in many savoury dishes is carrot, often in combination with other sweeter vegetables such as tomato, sweet potato, parsnip and squash. Few savoury meals have cauliflower, broccoli or other green vegetables as the main vegetable without a sweeter one added.

When claims are made for the number of fruit and vegetable portions in a product, it is not clear how these are calculated, and there is some confusion over the number of portions, and the number of types of vegetables, highlighted on labels.

Meat and fish

There are specific regulations relating to the amount of meat or fish that must be present in baby food, and the two most relevant recommendations are shown below.

- If meat, poultry, fish, offal or other traditional source of protein, singularly or in combination, are mentioned first in the name of the product, whether or not the product is presented as a meal, then:
  - the named meat, poultry, fish, offal or other traditional protein source, in total, shall constitute not less than 10% by weight of the total product,
  - each named meat, poultry, fish, offal or other traditional source of protein shall constitute not less than 25% by weight, of total named protein sources,
  - the protein from the named sources shall not be less than 1g/100kJ (4g/100kcal).
- If meat, poultry, fish, offal or other traditional source of protein, singularly or in combination are mentioned, but not first, in the name of the product, whether or not the product is presented as a meal, then:
  - the named meat, poultry, fish, offal or other traditional protein source, in total, shall constitute not less than 8% by weight of the total product,
  - each named meat, poultry, fish, offal or other traditional source of protein shall constitute not less than 25%, by weight, of total named protein sources,
  - the protein from the named sources shall not be less than 0.5g/100kJ (2.2g/100kcal),
  - the total protein in the product from all sources shall not be less than 0.7g/100kJ (3g/100kcal).

The products we reviewed had a variety of sources of meat and fish including lamb, pork, chicken, turkey, beef, cod, salmon or pollack, with a small number containing ham. The majority of products contained 10-11% meat or fish, just meeting the minimum legal requirements. Only five savoury meals (3% of savoury meals) had 12% or more meat or fish. The meal that had the highest proportion of meat was Cow & Gate's 'Carrot, lentils and pork', from their 10 months + Friends range, which contained 18% pork.

Some products we reviewed in 2016 did not appear to meet the minimum amount of meat or fish required (see Table 11). For more information on the compositional regulations for baby food, see page 87.

Table 11: Baby foods not meeting minimum meat and fish compositional requirements

In the following products, the meat or fish should constitute not less than 10% by weight of the total product.

Brand	Age range	Name	Ingredients
Heinz	7 months +	Lamb and winter vegetables	Water, vegetables (29%, carrot (16%), swede (5%), potato, onion), apple juice from concentrate and purée (22%), **lamb (8%)**, cornflour, sunflower oil, natural flavourings, iron sulphate
Cow & Gate	10 months +	Chicken pasta with tomato and mushroom*	Vegetables (63%) (tomato (49%), carrot, onion, mushrooms (3%), garlic), macaroni (14%) (durum wheat flour (contains gluten), egg white), **chicken (9%)**, potato, corn starch, cooking water, olive oil, parsley, vegetable oils (rapeseed, sunflower, vitamin E), oregano, thyme
Heinz	10 months +	Fish, peas and potatoes	Vegetables (57%, peas (26%), potato (20%), courgette, onion (5%)), water, Alaska pollock **(9%, fish)**, lemon juice from concentrate, cornflour, olive oil, parsley, iron sulphate

* This has now been renamed 'Pasta with chicken, tomato and mushrooms'.

The meat content can be lower (not less than 8% by weight) where the product name does not start with the meat or fish ingredient, even though it may appear to be a mainly meat dish – for example, if another ingredient is mentioned first. The products in Table 12 meet compositional regulations even though the meat content is very low, as the meat is not the first named component.

Table 12: Example baby foods that meet compositional requirements for a lower meat content by placing the meat product second in the name

In the following products where meat is mentioned, but not mentioned first in the product name, the meat should constitute not less than 8% by weight of the total product.

Brand	Age range	Name	Ingredients
Cow & Gate	4 months +	Carrot and lamb hotpot	Water, carrot (29%), potato (10%), **lamb (9%)**, peas, millet flour, wheat starch (gluten free), rapeseed oil.
Heinz	4 months +	Hearty veggies with turkey	Vegetables (42% carrot, parsnip, potato), rice, water, tomato, **turkey (8%)**, iron sulphate
Hipp Organic	4 months +	Sweet squash and chicken	Carrots* (28%), cooked rice* (24%), squash* (15%), water, **chicken* (8%)**, apricots*, apples*, rapeseed oil* (1.3%) * Organic
Heinz	7 months +	Mango chicken curry	Vegetables (55%, carrot (30%), tomato, courgette, onion), water, **chicken (8%)**, mango (8%), cornflour, sunflower oil, natural flavouring, iron sulphate
Cow & Gate	10 months +	Veggie and turkey casserole	Vegetables (38%) (carrot, tomato, mushroom, peas, leek, red pepper, celery), water, potato (19%), **turkey (9%)**, wheat starch (gluten free), rapeseed oil, thyme

Where a descriptive term is used – such as 'Caribbean', 'tangy', 'mini', or 'creamy' – immediately before the meat or fish ingredient, these products can contain the smaller amount of meat (8%) allowed in a dish where meat is not seen as the principal component, which may be surprising. See Table 13.

Table 13: Example baby foods using a descriptive name for a meat or fish dish that meets lower compositional meat or fish content requirements

In the following products, the meat or fish should constitute not less than 8% by weight of the total product.

Brand	Age range	Name	Ingredients
Heinz	4 months +	Caribbean pork casserole	Vegetables (31%, carrot, sweet potato (10%), courgette), rice, water, apple (15%), **pork (8%)**, sunflower oil, iron sulphate
Heinz	7 months +	Creamy fish pie	Vegetables (51%, carrot (13%), peas (11%), potato (9%), sweetcorn, onion), skimmed milk, **Alaska pollock (8%)**, Cheddar cheese (6%), cornflour, parsley, iron sulphate
Cow & Gate	7 months +	Succulent pork casserole	Vegetables (51%) (carrot (30%), tomato, butternut squash, onion, garlic), cooking water, potato (12%), **pork (9%)**, rice flour, tapioca starch, rapeseed oil, parsley, black pepper
Cow & Gate	7 months +	Yummy harvest chicken	Carrot (31%), water, potato (19%), tomato purée, **chicken (9.5%)**, wheat starch (gluten free), rapeseed oil, parsley
Heinz	10 months +	Fruity chicken and rice	Vegetables (32%, carrot, potato, onion), water, apple juice from concentrate (17%), rice (16%), **chicken (8%)**, cornflour, apricot (3%), sunflower oil, iron sulphate

In mixed dishes not considered as primarily meat or fish dishes, these rules do not apply. For example, 'Spaghetti Bolognese', 'Lancashire hotpot' or 'Pasta carbonara' can include as little as 5% meat. See Table 14.

Table 14: Mixed dishes which do not have to meet minimum meat compositional requirements, although they may be seen as meat dishes

Brand	Age range	Name	Ingredients
Hipp Organic	7 months +	Spaghetti carbonara	Water, cooked spaghetti* (durum wheat*) (25%), skimmed milk*, cooked rice*, onions*, **ham (5%),** grated hard cheese* (3%), egg yolk*†, rapeseed oil (0.9%), spices* (parsley*, garlic*, pepper*). * Organic, † Produced to EU standards
Hipp Organic	7 months +	Lancashire hotpot	Vegetables* (60%) [potatoes* (25%), carrots*, peas*, tomatoes*, onions*], water, cooked rice*, **lamb* (5.0%),** rapeseed oil* (1.2%), herbs* (oregano*). * Organic
Hipp Organic	10 months +	Pasta carbonara	Water, cooked pasta* (durum wheat) (25%), skimmed milk* (21%), cooked rice*, onions*, **ham* (5.0%),** grated hard cheese* (3%), egg yolk*‡, rapeseed oil* (1.5%), herbs* and spices* (parsley*, garlic*, pepper*) * Organic, ‡ Produced to EU standards
Hipp Organic	10 months +	Spaghetti Bolognese	Vegetables* (51%) [tomatoes* (29%), carrots*, celeriac*, onions*], cooked spaghetti* (durum wheat) (34%), water, **beef* (5.0%),** rapeseed oil* (1.7%), herbs* and spices* (oregano*, basil*, garlic*, pepper*) * Organic

Summary

Most baby foods containing meat and fish contain the minimum amount required to meet regulations.

By naming a meat product with a descriptive name (for example, 'Scrummy lamb hotpot' instead of 'Lamb hotpot'), or putting another ingredient first (for example 'Carrot and lamb hotpot'), the meat or fish content can be significantly lower (8%, compared to 10% if meat or fish is the first word in the name of the dish).

The meat or fish content of many baby foods is likely to be significantly lower than in home-made dishes, which may contribute to commercial foods having a lower energy and nutrient density, as well as lower amounts of some micronutrients such as iron and zinc compared to home-made foods.

Carbohydrates and sugars

In the data on the UK baby food products collected for this report, we found no clear pattern between carbohydrate content in meat-based and vegetable-based dishes. In the products surveyed, the carbohydrate content ranged from 4.6g to 15.6g per 100g. The fibre content of the products surveyed varied between 0.5g and 3.3g per 100g, and fibre content appeared similar in the meat-based and vegetable-based dishes, possibly due to the low meat content of many of the meat dishes, meaning that they, too, are predominantly vegetable-based.

Sugars

In 2015, the Scientific Advisory Committee on Nutrition (SACN) published new recommendations for the consumption of sugars (SACN, 2015). The report recommended that ideally no more than 5% of total dietary energy should be derived from free sugars. Whilst this recommendation does not directly apply to children under the age of 2 years, it would be prudent to limit the intake of free sugars among infants. The American Heart Association has recommended that no added sugars should be given to infants under 2 years of age (Vos et al, 2016). While introducing complementary foods, sugar intake should be limited, as it can encourage an acceptance of and preference for sweet foods, and cause tooth decay when the first teeth start coming through (Department of Health, 1994). A high sugar intake at the age of 3 years increases the risk of developing caries at the age of 6 (Karjalainen et al, 2001). In addition, intake of sweet foods in childhood can impact a child's weight and health throughout life, and is linked with obesity and diabetes (Drewnowski et al, 2012). Even relatively small amounts of added sugars in manufactured foods can make a significant contribution to overall intake in the diet of an infant. When making home-prepared foods, it is recommended that no added sugar is used.

Sugars appear on labels as 'total sugars', which is the sum of all sugars present in a food, and can include both sugars present in fruit, vegetables and milk, and sugars that have been added to foods such as sucrose, or sugars from fruit juices. It can be difficult to determine from product labels where sugars originate from unless the exact ingredient proportions are known. This is important, as evidence shows that it is the sugars that are added to foods, as opposed to those enclosed in the cell structure of foods such as fruit, that have a detrimental effect on long-term health (SACN, 2015). If sugar is listed as an ingredient, it means that sugar has been added to the product.

We asked manufacturers why they did not label added or free sugars in foods.

> **Cow & Gate:** *"EU labelling rules require that the value of total sugars is given on a product label; a declaration on added sugars is not required. Cow & Gate labels declare the values coming from all sources from all ingredients e.g. contributions from lactose in milk, those naturally occurring in fruit etc."*
>
> **Heinz:** *"Our labelling has to conform to the legal requirements of European legislation which included total sugars."*

EU baby food composition regulations have restrictions only on the maximum total carbohydrate content of fruit-only dishes and desserts and puddings:

"The quantities of total carbohydrates present in fruit-only dishes, and desserts or puddings shall not exceed:

- 20g/100g for fruit-only dishes
- 25g/100g for desserts and puddings."

Only one product appears to slightly exceed this figure. Ella's Kitchen 'Bananas, bananas, bananas' has 20.2g carbohydrate/100g.

Analysis of sugars in puréed fruit and vegetables, based on baby foods in the US, has reported that the amount of analysed sugars was significantly greater than that reported on the label (Clifford et al, 2014). Some of the differences in the products analysed are shown in Table 15.

This suggests that the maceration of foods for purées, heat treatment, and potentially storage, may mean that these foods are much higher in free sugars than would be suggested from the ingredients on the label. Walker and Goran (2015) also analysed the sugar content in commercial baby food and found that many products contained sugars in amounts that differed significantly from nutrition labels, also suggesting that many baby foods have a much greater proportion of sugars present than reported. The authors concluded that many products marketed to, and consumed by, infants and young children, contain sugars that are far in excess of what is considered nutritionally beneficial and/or are different from that stated on nutrition labels. The authors suggest that more accurate and comprehensive nutrition labelling of sugars in baby foods, based on analysed data, is needed.

Table 15: Analysed versus labelled amounts of sugars in a selection of baby foods marketed in the US

Baby food	**Analysed sugar content (%)** (Based on fructose, glucose and sucrose content)	**Reported total sugar content (%)**	**% greater sugar content analysed compared to reported value**
Apple purée	11.2	9.7	+15%
Green bean purée	3.4	2.7	+26%
Raspberry purée	12.1	9.2	+32%
Green bean and pear purée	11.5	7.5	+53%
Apple and butternut squash purée	11.6	7.5	+55%
Banana, peach and coconut purée	17.9	10.0	+79%
Banana peach and mango purée	16.7	9.2	+82%
Corn and butternut squash purée	11.8	2.7	+337%

Source: Clifford et al, 2014.

Sugars in processed fruit and vegetable purées are classified as added (free) sugar.

Sugars in processed fruit and vegetable purées are classified as added (free) sugars, since the sugars will have been fully liberated from the cell walls of the fruit or vegetables used (SACN, 2016). Evidence suggests that some processed fruit and vegetable commercial baby foods may have much greater sugar contents than would be expected to be present based on the ingredients. It is unclear at what point the sugars are considered to be intrinsic to the fruit or vegetables in baby foods with soft lumps, but it is likely that a high proportion of the sugars in processed baby food will be considered as added sugars. In contrast, foods that are made at home and mashed are likely to maintain much of the sugar in the structure of the fruit or vegetable. By simply tasting many of the fruit and vegetable purées in baby food ranges, it is obvious that they are considerably sweeter than a home-made equivalent. This is likely to be because the more intense macerating and heat treatment during processing liberates the sugars from the cell walls more effectively. As we want infants to become accustomed to the authentic flavours of fruits and vegetables, it may be prudent to avoid highly processed baby food fruit and vegetable purées.

What about home-made fruit- and vegetable-based baby food?

If baby food is made at home using soft whole fruits and vegetables, and if the food is minimally processed and used soon after preparation, much of the sugar will still be intact in the cells and not be as free sugars. If infants are introduced to solids at about 6 months of age, they may not need smooth foods, as many will be able to manage mashed foods and whole soft finger foods. Following each baby's lead will support their individual development. Buying very smooth commercial foods does not allow adaptation of texture for each baby, and does not promote the taste variations, chewing and swallowing babies need to learn to become confident eaters. Babies can be offered whole fruit and vegetables as finger foods, and ideally the fruit and vegetables offered in mixed dishes should be coarsely mashed, or later chopped as eating confidence increases.

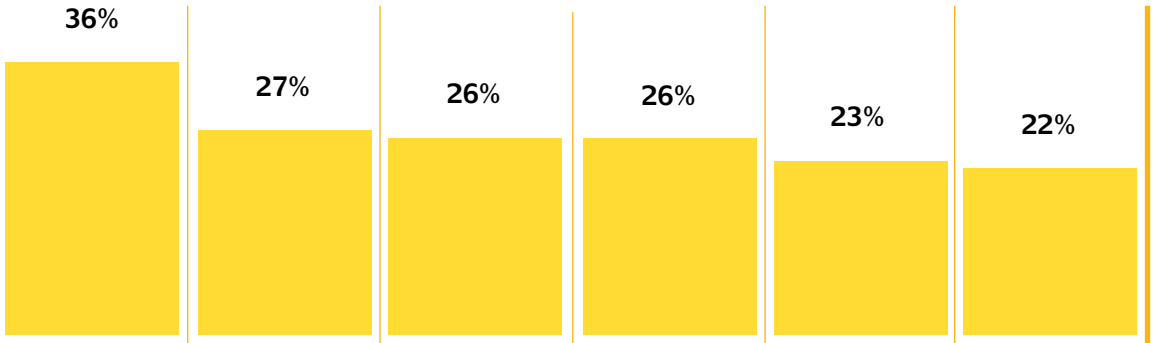
Other added sugars

The sugars in fruit juices are considered to be free sugars since they have been liberated from the content of the cell structure. A number of baby foods have fruit juice added and this can increase the sugar content considerably. There are also a small number of savoury meals where fruit juice concentrate has been used, either alone or in addition to whole fruit, to sweeten meals. Fruit juice concentrate occurs in a number of savoury dishes such as: Heinz's 'Sweet and sour chicken', which contains 20% apples and 15% apple juice from concentrate; Hipp Organic's 'Hearty vegetable, pork and apple casserole', which contains 4% apple juice from concentrate; Heinz's 'Lamb and winter veggies', which contains 22% apple juice from concentrate and purée; and Heinz's 'Broccoli and salmon risotto', which contains an undisclosed amount of apple juice from concentrate.

Some foods also have added sugar. Of the desserts and sweet foods surveyed for this report, just under a third (29%) contained sugar as an added ingredient.

The added sugar content can be estimated in products using the values for the sugar content of the known ingredients. Figure 2 provides some examples. It would be helpful if the amount of added sugar was included on labels.

Figure 2: Added sugars in baby foods



	Hipp Organic Cocoa and vanilla dessert 6 months +	Hipp Organic Rice pudding with apple and pear 6 months +	Heinz Rice pudding (multi-pack) 4-36 months	Cow & Gate Egg custard 6 months +	Cow & Gate Rice pudding 6 months +	Heinz Chocolate pudding (multi-pack) 4-36 months
Total sugars	14.3g/100g	9.0g/100g	7.0g/100g	8.0g/100g	7.7g/100g	8.3g/100g
Estimated added sugars	10.5g/100g	5.7g/100g **	4.6g/100g	5.2g/100g	5.1g/100g	4.5g/100g
Ingredients	Whole milk* (83%), **sugar***, rice starch*, rice flour*, low fat cocoa powder* (1.3%), natural vanilla flavour* (0.1%). * Organic	Whole milk (50%), water, rice semolina* (8%), **sugar***, apples* (5%), pears* (4%), thiamin (vitamin B1) * Organic	Whole milk (50%), water, rice (20%), **sugar**, cornflour	Skimmed milk (30%), full cream milk (30%), rice (29%), **sugar**, water, egg (3%), nutmeg (0.01%)	Full cream milk (54%), ground rice (34%), water, **sugar**	Whole milk (79%), water, **sugar**, cornflour, fat reduced cocoa powder (1%)

** Not including sugars from apple purée

Degradation of carbohydrates in baby foods exposed to high temperatures

Baby foods are often exposed to high temperatures during processing and this can decompose the sugars present to create compounds such as alpha-dicarbonyl compounds that have been associated with metabolic disorders (Kocadagh and Gökmen, 2014). In the study by Kocadagh and Gökmen, the key degradation compound found in baby foods was 3-deoxyglucosone. This compound has been found to induce insulin resistance (Liang et al, 2016). More work is needed to consider the impacts of processing on components of baby food, particularly those which are known to impact on metabolic disorders.

Acrylamide and furan in baby foods

There has been concern for many years about the development of compounds in foods when cooked at high temperatures. Acrylamide is a chemical that forms when starchy foods are cooked at high temperatures. Furan is formed from the thermal degradation of sugars, and is often found in products in cans or jars. Furan cannot escape when processed at high temperatures in sealed jars, so is likely to be present in jars and pouches of baby food. EFSA have produced guidance on acrylamide and furan in foods, as these are potentially carcinogenic compounds, and routine analysis of foodstuffs is undertaken in the UK. The most recent data reported (Food Standards Agency, 2017) examined 43 baby foods, 22 of which were in jars and pouches, and most of these were marketed for infants in the first year. The amount of acrylamide present varied from 3 to 60 micrograms/kg and the amount of furan from 3 to 81 micrograms/kg. It is known that infants and children are at highest risk of exposure to chemicals in food relative to body weight, and EFSA proposed an Indicative Level for jars and pouches of baby foods (not containing prunes) of 50 micrograms acrylamide/kg in 2013 (EFSA, 2013a). Only one product in the recent FSA analysis had an acrylamide level greater than 50 micrograms/kg. Currently no upper levels have been suggested for furan in food. However, there is concern about potential high levels of these compounds in the diets of infants, and whilst monitoring is in place to establish current exposure, maximum allowable levels should be established as a matter of urgency.

Summary

The sweet nature of many baby foods marketed for infants is of concern as a high sugar intake is linked to poor oral health, may accustom infants to very sweet tastes, and may contribute to overweight in later childhood. A diet free from added sugars in the first year of life is recommended.

Puréed processed baby foods based on fruits have a high added sugar content and should be avoided. The sugar content may be much higher in puréed foods than appears on the label and more data on the analysed sugar content of foods is needed.

Processing of carbohydrates at high temperatures may also result in the development of contaminants in foods (for example, acrylamide, furan or 3-deoxyglucosone). Maximum allowable levels of degradation product contaminants that have been linked to health risks should be established for baby foods.

There is no need for manufacturers to add fruit juice or extrinsic sugars to baby foods marketed in the first year of life, and these products should be phased out.

Protein

From 6 months of age, due to the infant's rapid growth rate, complementary foods should support increased protein requirements. The Reference Nutrient Intake (RNI) for protein for infants aged 6 months is 12.7g/day, increasing to 14.9g/day by 12 months old (Department of Health, 1991). However, there are now concerns that high protein intakes in the complementary feeding period are linked to increasing bodyweight (Pimpin et al, 2016). As the infant's age increases, the amount of protein in the marketed baby foods increases, both per 100g and per portion, as seen in Table 16.

Table 16: Protein content of commercial baby foods

Age	Average protein content of commercial baby foods		RNI (g/day)
	Per 100g (g)	Per portion (g)	
6 months +	2.7	3.2	12.7
7 months +	3.1	4.9	13.7
9 months +	3.7	8.2	13.7
12 months +	3.2	7.1	14.9

Garcia et al (2013) reported that savoury manufactured spoonable foods generally had a lower protein content compared to home-made food, and the authors concluded that 50g of a home-made family food would provide the same amount of energy and protein as 100g of a ready-made manufactured baby food. The average protein content of commercial spoonable foods in their survey was 2.3g/100g, ranging from 0.5g/100g in fruit dishes to 3.1g/100g in savoury meals containing meat or fish. The foods we have reviewed are slightly higher in protein than those reported in that study, which might reflect the changes in ranges on offer and the types of foods reviewed.

Protein content of meals that do not contain meat, fish or cheese

EU regulations state that, if the product is designated on the label as a meal, but does not mention meat, poultry, fish, offal or other traditional source of protein in the name of the product, the total protein in the product from all sources shall not be less than 0.7g/100kJ (3g/100kcal).

Ella's Kitchen's 'Veggie couscous with herbs' (6 months +) has 1.2g protein in 45kcal, which is equivalent to 2.7g protein/100kcal, and is the only product which appears to break this rule. However, many other vegetable-based products are low in protein, and only achieve 3g protein/100kcal because they have very low energy density. For example, Ella's Kitchen's 'Thai curry with noodles and vegetables' (10 months +) has 1.5g protein per 100g, but an energy content of only 50kcal/100g. This means that an infant has to eat 200g to obtain 3g of protein. For more information on why energy density matters, see page 29.

Summary

The protein content of commercial baby foods is sufficient, but infants often have to eat large volumes of food to obtain the protein present in a portion of commercial baby food. Home-made foods are likely to have greater amounts of higher protein ingredients and will therefore be more protein-dense, and also have higher amounts of iron and zinc.

Fat and fatty acids

The fat in commercial baby foods comes primarily from the meat, fish or dairy components or from the addition of rapeseed oil or sunflower oil. Hipp Organic and Cow & Gate primarily add rapeseed oil or a combination of rapeseed and sunflower oils, and Heinz use sunflower oil. Ella's Kitchen does not add oil, except for a small amount of olive oil to one pasta dish.

Both Hipp Organic and Cow & Gate make claims about the omega-3 fatty acid content of their foods based on the rapeseed oil used. Cow & Gate make claims about how much omega 3 fatty acids the dish contains as a proportion of the manufacturer's recommendation. For example, they say that in Cow & Gate's 'My first Bolognese':

> *" ... there is 62% of Cow & Gate's recommended daily Omega-3 intake (4-6 months) per jar."*

Hipp Organic also make claims related to the alpha linolenic acid (ALA) from rapeseed oil in their foods, and in the advice section on their website they say:

> *"Omega 3 unsaturated fats play an essential role in the body. They are an important component of the eyes and brain, so they're very important during the rapid visual and neurological development that happens during infancy.*
>
> *To make sure your baby's getting enough Omega 3, we've added rapeseed oil to our stage 1, 2 & 3 savoury jars. Rapeseed oil provides alpha-linolenic acid, which is converted to omega 3 in the body. Each jar contains at least 25% of your baby's recommended daily intake of ALA (RDA = 0.39g per day for 4-12 month olds)."*

We do not have a specific recommendation for ALA intake in the UK. Both Hipp Organic and Cow & Gate make their claims for the amount of ALA in foods for infants based on a recommended amount of ALA for infants of 0.5% of energy per day, taken from EFSA dietary requirements for infants published in 2013 (EFSA, 2013b).

In 2011, EFSA allowed the following health claim on foods for babies 0-3 years, after an application by Hipp Organic (EFSA, 2011):

> *"Alpha-linolenic acid, an essential fatty acid, contributes to brain and nerve tissue development."*

This claim is not related to eye development as the Hipp Organic website information suggests.

A recent review of fatty acids in baby foods reported that there was considerable variation between the amount of ALA stated on the label and the amount found by analysis (Loughrill et al, 2015). The authors suggest this is likely to be related to the adverse impacts of food processing, which are not always considered when labelling information is calculated from ingredients. Fatty acids are easily oxidised by oxygen in the presence of heat, light, metal ions and other factors, and it is established that rapeseed oils are more easily oxidised because of their higher polyunsaturated fatty acid content (Koski et al, 2002). In one product they highlighted, the label states an omega-3 content of 0.59mg/g, but the analytical value was determined as 0.012mg/g. The mean amount of ALA found in the foods analysed was 0.034mg/g. The authors conclude that infant foods are likely to be poor sources of long chain fatty acids.

We asked Cow & Gate and Hipp Organic about whether the amount of omega-3 in products was calculated or analysed.

> **Cow & Gate:** *"Omega-3 content is first calculated from the values disclosed in the raw material specifications. After recipe development the omega-3 content is confirmed by compositional testing to ensure it is valid and accurate."*
>
> **Hipp Organic:** *"For our complementary food, we are using organic rapeseed oil, which is nearly free from erucic acid. Naturally we analyze this raw material for its composition of fatty acids and its ALA content."*

Summary

Cow & Gate and Hipp Organic use rapeseed oil in their foods to make claims about the amount of the omega-3 fatty acid ALA present. Recent research suggests that the ALA content of the oil used in baby foods may be significantly reduced during processing, and therefore more information is needed as to whether the values used on packaging are analysed or calculated values.

Salt

Foods containing added salt should not be given to infants, as their kidneys are not yet developed enough to cope with the high solute load (Agostoni et al, 2008). A high salt intake encourages a preference for salty foods, which lasts beyond infancy (Department of Health, 1994). Most baby foods say on the label that they are low in salt.

The Department of Health recommends that foods high in salt, such as cheese, bacon and sausages, should be limited (Department of Health, 2004). However, there appear to be some baby foods on the market containing high-salt ingredients such as cheese and ham, which may give the misleading impression that it is suitable to give these foods to babies regularly. Some manufacturers claim that their products contain 'no added salt', whilst still containing ingredients that have a high salt content – for example, Cow & Gate's 'Pasta with tomato, spinach and cheese' for 10 months +. A few Hipp Organic products for 9 months + contain salt in vegetable stock.

Reducing high-salt food and avoiding the addition of salt to meals in the first years of life is important to minimise the preference for salty foods later in childhood.

EU regulations state that the final sodium content in the product shall be either not more than 48mg/100kJ (200mg/100kcal), or not more than 200mg per 100g. Most manufacturers put the salt content rather than the sodium level on their labels, but Hipp Organic put both values. No foods in our review exceeded these amounts.

Summary

The salt content of commercial baby foods marketed in the UK is low, but some more salty ingredients are included and may give the impression that foods such as cheese and ham in unspecified amounts are suitable for infants.

Micronutrients

Baby foods rarely declare the amounts of micronutrients on the label, with the exception of sodium on all foods, and iron on some foods where this has been added. Some desserts provide information on the thiamin, vitamin C and calcium content, but not consistently. There is limited data on the micronutrients in commercial baby foods, but it is likely that the high-pressure cooking they are exposed to in production will reduce the amounts present of some vitamins.

B vitamins

Zand et al (2012c) looked into the amounts of riboflavin and pyridoxine (vitamin B6) in commercial infant meals. They analysed eight different jars of meat- and vegetable-based baby foods from leading UK supermarkets, and riboflavin was not found at a detectable level in any of the products. In addition to leaching and degradation via the heating process, this lack of riboflavin could be explained by its sensitivity to light while stored in glass jars. The amount of pyridoxine detected in the meat and vegetable baby foods was 0.052 and 0.056mg/100g respectively, which can be compared with an RNI for infants for pyridoxine of 0.2-0.4mg/day.

Vitamin A and vitamin E

Loughrill et al (2016a) anlaysed the amount of vitamins A and E in eight commercial baby foods (four meat-based and four vegetable-based) from four brands. There was no significant difference in retinol, carotenoids or vitamin E levels between meat-based and vegetable-based products, reflecting the common use of carrot in many dishes and the limited amount of animal-based ingredients which are good sources of retinol.

Iron

When looking at packaged baby foods, of the four main manufacturers of packaged baby foods, Heinz are the most consistent when listing the iron content of their products, whereas Hipp Organic only occasionally list it, and Cow & Gate and Ella's Kitchen do not provide iron content. Iron is not added to organic baby foods.

As the infant develops and their requirements change, complementary foods must be introduced to increase the amount of iron in a baby's diet and replete the infant's iron stores (Garcia et al, 2013). Current advice recommends that high-iron foods such as meat, fish, eggs, pulses, cereals and vegetables are offered from 6 months to ensure that babies obtain sufficient iron from food. It is perfectly possible to obtain enough iron in the diet if a 'food first' approach is followed (using simple minimally processed and unprocessed foods rather than processed fortified foods) with a good variety of nutrient-dense meals. Information on how this can be achieved can be found in our resource *Eating well: The first year.*

Garcia et al (2013) reported that the average iron content of spoonable baby foods was 0.67mg/100g, with the highest average found in savoury meals with meat or fish (0.83mg/100g). The iron content of non-fruit-based desserts was particularly low at 0.2mg/100g. The authors also compared commercial baby foods with family home-made equivalents and reported that the iron content was variable across both home-made and commercial foods.

Many commercial baby foods are based on fruits and vegetables and the amounts of higher iron components such as meat, fish, eggs, pulses and green vegetables are low. The addition of some supplementary iron sulphate to some baby foods also means comparisons are difficult. A recent analysis of the iron content of eight baby foods in the UK reported a range in iron content of between 0.12mg/100g in Creamy cauliflower cheese to 1.26mg/100g in Cheesy tomato pasta stars (Loughrill et al, 2016b). Two of the eight dishes had added iron, and in these dishes the analysed iron content was 1.17mg/100g and 1.26mg/100g respectively. The mean iron content of the dishes excluding those with added iron was 0.48mg/100g. The mean iron content of these eight dishes was 0.66mg/100g, and the two meat dishes included had 0.31mg/100g and 0.79mg/100g respectively, reflecting the limited additional iron from the low meat content of the dishes. This was also found in another study by Zand et al (2011) who reported no significant difference in iron content between meat- and vegetable-based dishes.

Home-made baby food will offer higher iron intakes if families use a greater proportion of higher iron ingredients such as meat, fish, eggs and pulses, and base baby meals on family foods rather than on commercial foods. As home-cooked foods are significantly less processed, the iron content is more stable (Pan American Health Organization / WHO, 2001).

Other micronutrients

Loughrill et al (2016b) analysed eight savoury baby foods marketed for infants aged 7 months + and 10 months + for mineral elements. In Table 17 we have reported the average figures and ranges from that study, and compared them to the reference nutrient intakes (RNI) for infants aged 7-12 months to show what proportion of micronutrients these meals would provide in a 200g meal. This would provide about 150kcal, approximately one-third of an infant's energy requirement from food at 7-12 months. The range of micronutrients in meals is variable and only sodium, phosphorus and potassium on average provided one-third of intakes, with iron and zinc contents much lower than the contribution of energy might suggest.

Zand et al (2011; 2012a, b, c) carried out a series of investigations on eight popular manufactured baby foods. Once the foods were analysed, the authors constructed the foods (along with formula milk) into a representative daily diet for an infant. They found that the daily intake of a number of micronutrients, including iron, zinc, calcium, magnesium, selenium and B vitamins riboflavin and pyridoxine fell below daily recommended intakes when compared to the requirements of a 6-9 month old infant.

We asked the manufacturers if they could provide us with information on the micronutrient content of their baby foods, and how they analysed this. Their responses are given below.

Ella's Kitchen and Cow & Gate replied that they would provide the information only if the relevant authorities requested it.

> Heinz: *"We are confident that the composition of our baby foods meeting our exacting nutritional specifications and all requirements for the declared values as part of the nutrition information shown on our labels. Information on micronutrients can be provided if requested."*

We requested this information but had not had a response by the time this report went to print.

> Hipp Organic: *"Based on the legal requirements we carry out analysis if necessary. We don't forward any further micronutrient analysis results besides the labeled information as part of our standard procedures, but we do on occasion send micronutrient analysis to dietitians on request."*

Table 17: Analysed micronutrient amounts in a range of baby foods compared to reference nutrient intakes for infants aged 7-12 months

Nutrient	Mean (and range) of analysed micronutrients in 8 savoury baby foods* (mg/100g)	Percentage of the RNI[1] for an infant of 7-12 months provided by a 200g meal of baby food Mean and (range)
Calcium	75 (36-110)	28 (14-42)
Phosphorus	63 (52-78)	32 (26 -38)
Iron (based on 6 foods without iron added)	0.48 (0.12-1.2)	12 (3-30)
Zinc	0.44 (0.35-0.59)	16 (14-24)
Magnesium	10.7 (8.9-13.2)	28 (24-35)
Potassium	130 (76-237)	38 (22-68)
Sodium	68 (33-98)	40 (20-59)
Copper	0.04 (0.02-0.12)	26 (13-80)

* The foods analysed were Creamy tomato and leek pasta, Creamy cauliflower cheese, Cheesy tomato pasta stars, Cheesy pie, Pasta carbonara, Broccoli cheese, Cheesy spaghetti with 5 vegetables and Spaghetti Bolognese.

1 Reference nutrient intakes are taken from *Dietary Reference Values for Food Energy and Nutrients for the United Kingdom* (Department of Health, 1991).

Summary

High-heat processing of commercial baby foods may mean that many have low or minimal contents of important vitamins such as riboflavin. Modelling suggests that babies fed only infant formula and commercial baby food may not meet their requirements for some essential nutrients. More information is needed on the micronutrient content of highly processed baby food, and manufacturers are encouraged to be transparent about any analysis of products they carry out.

Textures and thickeners

It has been reported that most baby foods marketed for infants in the first year are smooth, or smooth with soft lumps. Manufacturers often make claims about the smoothness of their products. It has been commented by others that baby foods are predominantly smooth (Garcia et al, 2013), but it is thought that the timing of exposure to varied textures is an important part of the complementary feeding process (Mennella, 2014). It has been reported that 6-12 month olds who experienced a variety of different textures of apple sauce preferred greater texture complexity, and that 7 year old children who were introduced to lumpy solids after 9 months of age compared with between 6-9 months ate less of many food groups, including a wide range of fruits and vegetables, and were reported to have more feeding problems (Lundy et al, 1998).

Puréeing food alters the cellular structure of foods, changing texture and making foods more viscous. It also changes the flavour of the food by dispersing volatile elements that would normally be released during chewing, altering how flavour is experienced (Wilson and Brown, 1997). Rapley, in her paper on whether puréed foods are justified for infants, argues that evidence suggests that offering purées limits the pleasure of eating as other senses are not stimulated and that purées can lead to overeating in infants as care-givers cannot respond to hunger cues when food is swallowed rapidly (Rapley, 2016). Rapley also suggests that rapid oral processing limits the amount of time food can mix with the saliva in the mouth to start the digestive process, limits appreciation of flavours and may challenge the development of oral-motor skills.

When asked about the texture of their food, Heinz said:

> *"Heinz texture guidelines for infant and toddler foods provide a guideline for suitable textures for each developmental stage to reduce the risk of choking while promoting the necessary progression from milks to family foods. These recommendations are based on existing clinical evidence on texture and choking, along with personal communications with Key Opinion Leaders."*

There is considerable discussion about choking risk, food choice and texture and developmental readiness for swallowing, and the most important thing, however infants are fed, is that they are never left alone when eating (Cichero, 2016). There is no evidence, however, that infants fed with a baby-led weaning approach choke any more than those traditionally fed (Fangupo et al, 2016).

There has been increasing recognition that it is infant developmental readiness for solids that should determine when foods are introduced complementary to breastmilk (or infant formula). Smooth puréed baby foods were developed when infants were weaned before they were able to swallow effectively. There is little need for puréed smooth foods for most infants once they have become accustomed to handling food in their mouth, but each infant will develop at their own pace. When food is home-prepared, it is easier for care-givers to follow the infant's lead on the food they can manage to chew and swallow. Most experts agree that a combination of self-feeding by infants and the delivery of nutrient-dense foods on a spoon, in textures appropriate to each infant, is a sensible way to support infants eating in the second 6 months of life.

Thickeners

A number of ingredients are used in baby foods as thickeners. Those used in the foods we reviewed are listed in Table 18. Generally, thickeners are used in food processing to make sure foods are a consistent texture. They are frequently starch-based.

Table 18: Ingredients used as thickeners in baby foods

4 months +	6 months +	9-12 months
Corn starch / cornflour	Amaranth flour	Amaranth flour
Gluten-free wheat starch	Corn starch	Corn starch/ cornflour (especially in Heinz products)
Ground rice	Cornflour	Gluten-containing wheat flour
Rice flour (in desserts)	Gluten-containing wheat flour	Gluten-free wheat starch
Rice starch	Gluten-free wheat starch	Rice flour
Tapioca starch	Ground rice	Rice starch
	Oat flour	Tapioca starch
	Rice flour	
	Semolina (in yoghurt)	
	Tapioca starch (in yoghurts)	
	Wheat flour	

Summary

Most commercial foods marketed for infants in the first year are smooth, or smooth with soft lumps, and it is likely that most infants are able to manage a faster progression to mashed and chopped foods than these products encourage.

Puréed foods offer a different taste and texture profile compared to the foods they are made from, pass rapidly through the mouth and may limit appreciation of flavours. They may also lead to over-eating, as food that can be rapidly swallowed makes it more difficult for care-givers to know when the infant has had enough to eat.

Packaging, storage, safety warnings and usage instructions

In a report by Neilson (2015), sales of baby food pouches increased globally by 28% between 2013 and 2014. A large proportion of baby foods in the UK are marketed in pouches, and the ranges appear to be increasing, with a move away from glass jars. The volume of food in individual pouches is generally lower than that marketed in jars, but the cost is usually higher.

Pouches have advantages over jars for manufacturers in that they are less heavy, are easier to transport, the package allows for a greater surface area for graphics, product information and pictures, and the contents inside the pouch cannot be seen. Whilst sucking from the pouch is not encouraged, it is common to see children do this, and families may see giving the children the pouch to eat directly from as a 'mess-free' option for infant feeding, without the need for spoons, bowls and washing up.

Why buying food in pouches and allowing infants to suck from the pouch is not recommended:

1. Sucking from a pouch does not encourage the learning of, and use of, chewing skills.
2. Children cannot distinguish what it is they are eating, and cannot see or smell the food easily.
3. Children who are given smooth foods in pouches for longer periods may become fussier eaters.
4. Children develop fine motor skills when picking up food or playing with it.
5. Puréed fruit and vegetables in pouches are high in free sugars, and sucking these foods across the teeth may contribute to tooth decay.
6. There is no portion control if food is eaten directly from the pouch, and there may be considerable food waste.
7. Food pouches are not recyclable and contribute to landfill.
8. The cost of pouches is high and much of the cost is for the convenience of this type of packaging.
9. The lids of pouches are a potential choking hazard, which the companies acknowledge.

Most manufacturers indicate that food in pouches should be transferred to a bowl for serving, or be served on a spoon (see Table 19). We asked Ella's Kitchen why they had a photo of a baby sucking from a pouch on their website. They replied:

> *"We are in the process of reviewing our website content to bring it in line with our recommendations on pack and in communications. While we don't advocate little ones consuming the product directly from the pouch, we have feedback from many parents that their little ones do this at around the age of 1 year."*

It therefore appears that Ella's Kitchen supports the consumption of foods from pouches for children over the age of 1 year, despite the importance of children being able to recognise the food they are eating and taking part in family meals at this stage.

The materials used for pouches are generally plastic layers with an aluminium core, and there is currently little available published data about the health and environmental consequences of this type of packaging.

Ella's Kitchen, on their website, say this about their pouches:

> *"Our pouches use 80% less materials than many alternative forms of packaging. An independent audit of the life cycle of our pouches has shown that the energy used, and the environmental impact made when making, transporting and destroying them, is significantly less than PET plastic bottles, Tetra Packs and glass."*

We asked if we could see this independent analysis but Ella's Kitchen were unable to make it available.

As the number of foods marketed in pouches appears to be increasing, an analysis of the environmental impact of this in the UK is recommended.

Storage, warming and safety instructions

Table 19 summarises the instructions and information on storage, warming and safety for the main brands of baby food reviewed in this report. Whilst all brands say that food in pouches should be served in a bowl or from a spoon, none say specifically to avoid letting babies suck the contents directly from the pouch. Instructions on heating with a microwave vary: some say never to do this, while others say to do this with care or to use this method of re-heating.

None of the products in our review gave information about re-heating food that had been previously heated, and not all companies explain that any food decanted from the jar or pouch before eating should be discarded. Jars all state they can be stored for 48 hours once opened, and pouches for 24 hours. Safety warnings about the products vary, but most companies acknowledge that the caps of pouches are a potential choking risk. Only Hipp Organic and Cow & Gate say babies should not be left alone when feeding on some of their products.

Table 19: Storage, warming and safety instructions for jars, pouches and tray foods for babies aged up to 12 months

JARS			
Brand	**Storage once opened**	**Warming**	**Safety instructions**
Cow & Gate	Food left in the jar can be stored in the fridge for up to 48 hours. If feeding direct from the jar, the unused portion must be discarded.	Stir well and serve your baby's portion into a clean bowl. To warm, stand in hot water. Take care if microwaving. Stir well and always check temperature before feeding.	Safety button on lid: do not use if raised or damaged.
Heinz	Once opened, unheated food left in the jar can be stored in the fridge for up to 48 hours.	Spoon into a bowl. To warm, stand in hot water. If microwaving, take care. Always check the temperature before serving.	Reject if cap button is raised.
Hipp Organic	Once opened, replace cap, keep refrigerated, and use within 24 hours. Never re-heat baby foods.	Stir contents of jar using a plastic spoon, put required amount into a clean bowl. Serve at room temperature or stand bowl in hot water to warm. (If using a microwave, take great care as hot spots can occur.) Always check temperature of food before feeding. Never re-heat baby foods.	This product left our factory in a faultless condition – please ensure that the jar and the cap are undamaged before feeding.

POUCH AND NOZZLE			
Brand	**Storage once opened**	**Warming**	**Safety instructions**
Cow & Gate	Once opened, pouches can be re-sealed and stored in a fridge for up to 24 hours if fed by spoon.	Open pouch and squeeze purée onto a baby spoon. Feed your baby from the spoon at their own pace.	Do not leave your baby alone when feeding. If damaged do not serve.
Ella's Kitchen 4 months +	Keep me in a cupboard. Once opened, I can be kept in the fridge for up to 24 hours. Do not reheat me.	Squeeze me into a bowl or straight onto a spoon. To warm me, stand me in hot water and check I'm not too hot. Never put my pouch in a microwave.	My cap could be a choking hazard to children under 36 months. Please always keep out of their reach. If I am damaged or look inflated with air, do not feed me to your baby.
Ella's Kitchen 7 months +	Keep me in a cupboard. Once opened, I can be kept in the fridge for up to 24 hours. Do not reheat me.	Squeeze me into a bowl or straight onto a spoon. To warm me, stand me in hot water or squeeze me into a saucepan. Always be careful, hot food can burn. Always test my temperature before feeding me to your baby. Never put my pouch in a microwave.	
Hipp Organic 4 months +	Any unwarmed purée left in the pouch can be resealed and stored in the fridge for 24 hours. Any purée decanted into a bowl should be discarded after use.	Squeeze the purée on to a spoon or into a bowl for feeding. Serve at room temperature or stand pouch in hot water to warm. Always check temperature before feeding. Do not heat pouch in a microwave.	Please do not leave children under the age of 36 months unattended with this product, due to a risk of choking on the cap. Please ensure the pouch is undamaged and try before feeding.
Hipp Organic 7 months +	Any unwarmed food left in the pouch can be re-sealed and stored in the fridge for 24 hours. Any food decanted into a bowl should be discarded after use.	Squeeze the food onto a spoon or into a bowl for feeding. Serve at room temperature or stand pouch in hot water to warm. Always check temperature before feeding. Do not heat pouch in a microwave.	
Heinz	Once opened, replace cap, keep pouch in the fridge and use within 24 hours. Can be frozen on day of opening.	Squeeze contents into a bowl or straight onto a spoon. To warm, stand in hot water. Always check the temperature before serving. Never microwave the pouch.	Remove cap and keep it out of reach of baby.

RIP-TOP POUCH			
Brand	**Storage once opened**	**Warming**	**Safety instructions**
Ella's Kitchen	Keep me in a cupboard. Once opened, I can be kept in the fridge for up to 24 hours. Do not reheat me.	To warm me, simply tear off the top of my pouch, stand me in hot water or squeeze me into a saucepan. You can also microwave me – pop me in standing up and whizz me around until warm. Always be careful, hot food can burn. Always test my temperature before feeding me to your baby.	If I am damaged or look inflated with air, do not feed me to your baby.

TRAY MEALS			
Brand	**Storage once opened**	**Warming**	**Safety instructions**
Cow & Gate	Do not heat in a conventional oven. Any unused portion must be discarded. Never re-heat Cow & Gate Little Steamed Meals.	**Hob** – From ambient. Remove plastic lid. Place sealed plate in hot water for 5 minutes. Remove and cool slightly under running tap. Remove film lid and stir well. Always check temperature before serving. **Microwave** – From ambient. Remove plastic lid. Pierce film top several times with a fork. Microwave on full power for 30 seconds (700/750W). Cooking time may vary according to microwave power. Remove the film and stir well to remove hot spots. Always check temperature before serving.	Do not heat in a conventional oven.
Hipp Organic	No refrigeration required. Store at room temperature. Unheated food can be stored, in a covered dish, in the fridge for up to 24 hours. If feeding direct from the tray, any remaining food at the end of the meal must be discarded. Never re-heat Hipp toddler meals.	**Hob** – From ambient. Remove the cardboard sleeve and place the sealed tray in hot water for 4-6 minutes. **Microwave** – From ambient. Remove cardboard sleeve and pierce the film lid several times. Heat in microwave (800w) for 50 seconds (cooking time may vary according to microwave power). Remove film and stir well to remove any hot spots and always remember to check the temperature before serving.	Take care not to overheat; do not heat in a conventional oven. This product left our factory in a faultless condition – please ensure that the pot and plastic film are undamaged before feeding.

Summary

Baby food is marketed primarily in jars and pouches, with pouches becoming increasingly popular. However, pouches are a more expensive way to buy baby food, there are risks that children will eat directly from the pouch, and pouches are not recyclable. Clearer warnings are needed on pouches, and in advertising, to deter parents from allowing children to suck directly from the nozzle.

As the number of foods marketed in pouches appears to be increasing, an analysis of the environmental impact of this in the UK is recommended.

The preparation, warming and safety instructions on baby food jars, pouches and trays vary and it would be useful if there were clear, consistent instructions across products.

All products should clearly state that babies should never be left alone when eating, as this is the most important thing to do to prevent choking and is not consistently stated on the packaging.

Cost of commercial baby foods

Cost of main meal baby foods

In general, the main meal products become more expensive and increase in size for infants as they progress through the different age bands. Within all age bands, products from Ella's Kitchen are the most expensive, and Cow & Gate or Hipp Organic products are the least expensive. The average costs of main meal products by manufacturer, the price range, and cost per 100g are shown in Table 20.

Figure 3 compares the costs of a similar dish (spaghetti Bolognese) from different manufacturers and shows considerable variation in cost per 100g.

Table 20: Costs of main meal baby products in the UK

Age range	Brand	Format	Product weight (g)	Product cost	Cost per 100g
4 months +	Cow & Gate	Jar	125	65p	52p
		Pouch	80	80p	£1
	Ella's Kitchen	Pouch	70	90p	£1.29
		Pouch	120	£1.10	92p
	Heinz	Jar	120	65p	54p
		Pouch	100	90p	90p
	Hipp Organic	Jar	125	85p	68p
		Pouch	100	£1	£1
6 months +	Cow & Gate	Pouch	100	95p	95p
	Ella's Kitchen	Pouch	120	£1.10	92p
	Hipp Organic	Jar	125	85p	68p
7 months +	Cow & Gate	Jar	200	80p	40p
		Pouch	130	£1.29	99p
	Ella's Kitchen	Pouch	130	£1.40	£1.08
	Heinz	Jar	200	77p	39p
		Pouch	130	£1.29	99p
	Hipp Organic	Jar	190	£1	53p
		Pouch	130	£1.30	£1
9 months +	Hipp Organic	Tray	230	£1.70	74p
10 months +	Cow & Gate	Jar	250	£1	40p
		Pouch	190	£1.80	95p
		Tray	230	£1.60	70p
	Ella's Kitchen	Pouch	190	£1.90	£1
	Heinz	Pouch	180	£1.65	92p
	Hipp Organic	Jar	220	£1.25	57p

Note: Prices were taken from Boots the Chemist or, where the product was not available there, from Tesco, Sainsbury or Asda online supermarkets.

Figure 3: Comparison of costs of spaghetti Bolognese produced by different baby food manufacturers

	Cost per 100g (Product cost)
4-6 months	
Cow & Gate My first Bolognese (Jar 125g)	**51p** (64p)
6 months +	
Hipp Organic Spaghetti Bolognese (Jar 125g)	**68p** (85p)
7 months +	
Heinz Spaghetti Bolognese (Jar 200g)	**39p** (77p)
Cow & Gate Scrummy spaghetti Bolognese (Jar 200g)	**40p** (80p)
Hipp Organic Spaghetti Bolognese (Pouch 130g)	**77p** (£1)
Cow & Gate Carrot, tomato, beef and pasta (Pouch 130g)	**99p** (£1.29)
Heinz Pasta Bolognese (Pouch 130g)	**99p** (£1.29)
Hipp Organic Spaghetti Bolognese (Pouch 130g)	**£1** (£1.30)
Ella's Kitchen – Lip smacking spag bol with a sprinkle of cheese (Pouch 130g)	**£1.08** (£1.40)
10 months +	
Cow & Gate Spaghetti Bolognese (Jar 250g)	**40p** (£1)
Hipp Organic – Spaghetti Bolognese (Jar 220g)	**57p** (£1.25)
Cow & Gate Spaghetti Bolognese (Tray 230g)	**70p** (£1.60)
Heinz – Spaghetti Bolognese (Pouch 180g)	**99p** (£1.79)
Ella's Kitchen Spaghetti Bolognese with cheese (Pouch 190g)	**£1.03** (£1.95)

Note: Costs were taken from Boots the Chemist website or, if unavailable at Boots, from Tesco supermarket website.

Cost of baby food desserts

Prices per product for desserts range from 33p to £1.50. Pouches are the most costly format in which to buy baby desserts, but some products are sold in multi-packs and pots. See Table 21.

Table 21: Costs of desserts

Age range	Brand	Average cost*	Range	Average product weight (g)	Average cost per 100g
4 months +	Cow & Gate	58p	44p-65p	117	49p
	Ella's Kitchen	£1	N/A	120	83p
	Heinz	45p	33p-65p	109	41p
	Hipp Organic	83p	75p-85p	114	73p
6 months +	Cow & Gate	65p	N/A	125	52p
	Ella's Kitchen	£1.05	£1-£1.09	95	£1.10
	Hipp Organic	97p	85p-£1	105	93p
7 months +	Cow & Gate	80p	N/A	200	40p
	Ella's Kitchen	71p	44p-£1.50	80	88p
	Hipp Organic	£1	N/A	169	60p

Note: Prices were taken from Boots the Chemist, or from Tesco or Sainsbury online supermarket.
N/A = not applicable

We have compared the costs of some home-made and commercial foods, and in all cases it is significantly more cost-effective to make your own higher-quality versions of baby foods than to purchase commercial versions. (See page 69.)

Summary

Commercial baby food varies in price across brands, with food in pouches costing significantly more per 100g of product than those sold in jars.

Families are paying a high price for convenience, and many of the commercial baby foods are poor value for money when considering the ingredients used compared to home-made equivalents.

Labelling and marketing

EU regulations require labels on baby foods to include:

- information about the age from which the product may be used, which must not be less than 4 months
- the presence or absence of gluten if the indicated age from which the product may be used is below 6 months
- the available energy value (in kJ and kcal), and the protein, carbohydrate and lipid content (in numerical form) per 100g or 100ml of the product as sold and, where appropriate, per specified quantity of the product as proposed for consumption
- instructions for appropriate preparation, when necessary, and a statement as to the importance of following those instructions.

Labelling requirements are adhered to by manufacturers, but many also make claims for baby food that suggest wholesomeness, naturalness, tastiness and convenience.

A selection of statements made by various manufacturers on the packaging of a range of baby foods is shown in Table 22.

Table 22: Claims found on packaging of baby foods

Claims relating to tastiness	Claims related to healthiness
• Delicious recipe • My flavours are a new journey for tiny taste buds • Real food and tasty flavours • Delicate flavours to nurture baby's palate • A tasty meal • Yummy mix • Steam-cooked veggies • Our finest ingredients • Our ingredients are picked at the peak of ripeness and steam-cooked to give you delicious baby food bursting with goodness and flavour • Inspired by a recipe from a mum just like you • Perfect for encouraging babies to explore more new tastes	• No added sugar • No added salt • Low salt • Naturally occurring sugars • Naturally occurring salt • No preservatives, artificial colourings or preservatives • No added milk products • Gluten-free • Nutritious ingredients only • A perfectly balanced nutritious meal • With omega 3 – important for the development of brain and nerve tissue • With added iron • Iron supports normal cognitive development • 60% of Labelling Reference Value: a guide to the amount of vitamin C for infants and young children • Contains 1 portion of veg • 2 of your baby's 5 a day • 6 different vegetables

Table 22: Claims found on packaging of baby foods *(cont.)*

Claims related to parenting	Other claims
• No guilt – just goodness • Ready to eat • As good as home-made • Easy prep • Delicious hot or cold • Keep me in a cupboard • My ingredients are suitable from 4 months ... The Government advises that you don't need to wean your little one until they are 6 months. Every baby is different. • Feeding babies for over 100 years	• Authentic recipes from around the world • A world of variety • Organic ingredients • Super smooth • Smooth for babies starting out • Smooth and mild • Thick purée • With little lumps for chewing • No really big lumps • Even more texture • Nothing artificial • Perfectly balanced for babies • Suitable for vegetarians • Created by experts • 100% halal • BPA-free • No GMO

BPA = bisphenol A (a type of plastic) GMO = genetically modified organism

Additional information on packaging

Many products invite users to look at the company's website for more information:

Cow & Gate: *"We're here to help candgbabyclub.ie"*

Ella's Kitchen: *"Let's be friends. Sign up at ellaskitchen.co.uk"*

Heinz: *"Keep in touch heinzbaby.co.uk"*

Hipp Organic: *"For handy hints and fantastic freebies to help wean your baby join Hipp.co.uk/wow"*

Print and web marketing

Baby food brands can use marketing messages that emphasise the time-saving benefits of using manufactured baby food, highlighting the hectic lives of mums and the many tasks they have to deal with every day. To assuage feelings of guilt, brands can communicate how their time is better spent engaging with their young children than cooking in the kitchen. This shifts the positioning of baby food products, from offering convenience to mums to being a means of spending more quality time with their little ones (Mintel, 2016).

There are many opportunities for manufacturers of baby food to market their products to parents. Careful scrutiny of social changes, trends and fads allows manufacturers to target appealing promotional messages for their baby foods not only via traditional methods such as product labels and TV advertising, but also via websites and social media.

Baby food manufacturers use a number of common themes and messages to encourage parents to purchase their products. Some of the common approaches are highlighted below.

- **Convenience**

The time-saving messages of using manufactured baby food is possibly one of the most established marketing messages in this area, highlighting the hectic lives of mums and the many tasks they have to deal with every day. The appeal, as with other convenience foods, is the time-saving aspect of these baby foods.

- **They are nutritionally complete or superior.**

Some of the messages strongly suggest that these manufactured foods are somehow more specifically tailored for babies' health and development. For example:

> Cow & Gate (website): *"Nutritionally tailored for every age and stage, our milks and foods are made to support your little one's development."*
>
> Hipp Organic (website): *"Made with the finest organic ingredients that are gently steam-cooked to maintain all the goodness and flavour to provide your baby with the best possible start to weaning and beyond."*

- **They have added nutrients that are associated with health.**

The use of nutrition and health claims on foods is regulated in the EU by Regulation (EC) 1924/2006. This regulation applies to all nutrition and health claims made on food packaging. The European Food Safety Authority (EFSA) holds a list of authorised nutrition and health claims that food manufacturers, including baby food manufacturers, are permitted to use, provided products meet the criteria for their use. Authorised claims have been substantiated by generally accepted scientific evidence.

This presents an opportunity for manufacturers to engage parents in the health benefits of nutrients at a time when they are often concerned about their baby's nutrient intake, especially as they move from a milk-based to a mixed diet.

Evidence shows that health and nutrition claims are particularly widely used in the baby food category. In a recent study (Hieke et al, 2016), the use of health claims on packaged foods across five European countries was examined. Of the countries sampled (the UK, the Netherlands, Germany, Slovenia and Spain), overall 26% of packaged foods had a nutrition or health claim. In the UK, just over 35% of foods had a nutrition and or health claim. However, what was notable was that the category of foods with the highest proportion of nutrition and health claims was *'foods for specific dietary uses'* – which includes foods intended for babies and infants. In this category, 78% of foods used a nutrition claim, and 71% used a health claim.

- **Use of 'free from ...'**

Parents place importance on baby foods that have no additives or preservatives or are free from common allergens. This is reflected in the market, in that 85% of new baby-food products in 2013 claimed to contain no additives or preservatives. The 'free-from' market is also growing, with the increasing communication and awareness of food hypersensitivities.

- **Organic**

Globally, sales of organic baby foods increased by 26% over 2013-2015, whilst non-organic products declined by 6% (Neilson, 2015). Organic foods have particular appeal to some parents who want foods that are minimally processed and free of additives, in the belief they are providing a healthier start for their baby.

Use of social media

Like most organisations, baby food manufacturers have turned to social media to engage with parents. Websites, Facebook, Twitter and Instagram play a role in marketing, especially in launches of new products. Feedback on products on these platforms from parents can be instant and allow further insight and targeting of messages by manufacturers.

Companies also engage with parents on social media by asking them to send in baby photos, enter competitions, and create baby storybooks. Companies also offer weaning charts and cookbooks, and promote special offers via Twitter, Facebook and parent helplines. Hipp Organic and Cow & Gate also manufacture breastmilk substitutes, and families are also targeted, through parental helplines relating to infant feeding, with cross-promotion of products and brands.

Summary

Manufacturers use a range of marketing techniques to promote the use of commercial baby foods, emphasising the convenience and healthiness of products.

Restriction on the inappropriate marketing of baby food is needed in the UK to ensure that families are not misled into buying products which undermine public health recommendations.

Health claims should not be allowed on any foods marketed to infants and children, as these can mislead purchasers into thinking processed foods are superior to home-made foods or to alternatives that are minimally processed or unprocessed.

Comparing home-made and commercial baby food

We have compared some commercial baby foods with home-made versions to look at the cost, appearance and volume of food needed.

When making the home-made versions, we did not recreate the dishes following the ingredients list on commercial products as these are not representative of dishes people are likely to make. For example, it would be difficult to make egg custard with 3% egg, and most meat and fish dishes would have 20-25% meat or fish, not 8-10%. For each of the foods, we looked at the name of the product and created a food which we felt would represent that dish if you were making it at home. For example, if a food was called 'Strawberry and mango', we suggest this would be made from 50% strawberry and 50% mango. For each comparison, we provide the list of ingredients used in the commercial version, and the ingredients used in the dish we have created.

For first foods, we show the same amount (by weight) of the commercial food and our version, so that you can compare colour, consistency and cost.

For meals and desserts, we calculated the energy content of our dish from the ingredients we used, and then calculated the amount of the home-made version that would have the same energy content as the commercial food. Commercial meals generally indicate that each jar or pouch is one portion. The size of meals therefore varies considerably, as jars are usually bigger in volume than pouches.

How did we cost the dishes?

Where the commercial food was made from organic ingredients, the costings for our versions were based on organic ingredients that can be bought in supermarkets. The majority of these prices were based on the Waitrose Duchy range or Waitrose own-brand organic range, but in some cases specialist organic food brands were used (e.g. Doves Farm organic cornflour).

Where foods were created from non-organic ingredients, we used standard supermarket prices for foods. Whilst manufacturers might argue that the ingredients they use have to be specially procured to meet specific pesticide and other contaminant levels, they are able to buy food in bulk at very competitive prices, and for many items these will be very similar to typically purchased family foods. For all the items, we ensured we costed for the ingredients as used, allowing for wastage of peel, cores and skin as outlined in McCance and Widdowson's *The Composition of Foods*, 7th edition (Finglas et al, 2015), and for appropriate drained weights of items such as canned pulses or fish.

We costed all ingredients as of October 2016 and therefore some costs were higher than they would be if food was in season. Also, we costed items based on those bought in small household quantities. Buying bigger amounts of ingredients, buying items on special offer, and buying in markets and cheaper supermarkets would make the dishes substantially cheaper.

We have shown in bold the most expensive ingredient in the recipes we costed, to illustrate how the costs of home-made dishes are influenced by the greater amount of more costly ingredients used. However, the much greater proportion of more expensive and more nutritious ingredients does not lead to higher prices for home-made versus commercial foods.

Are the home-made versions more nutrient-dense?

The home-made foods are likely to have a greater nutritional density and more nutrients overall as they have not been ultra-heat treated, generally have a greater amount of more nutritious ingredients, and have a lower moisture content. We have only compared energy content, as we do not have the micronutrient content of commercial foods to compare against.

Do the home-made foods taste better?

We tasted all the foods, both commercial and home-made. Whilst our taste perceptions were subjective and represent adult tastes, the commercial foods were generally bland compared to home-made foods, and key flavours were very difficult to detect. In many commercial dishes where multiple ingredients are used, it is almost impossible to detect what is in the meal visually or by taste.

Key points

We compared 40g of a range of baby foods marketed as first foods, with our own home-made versions, to show differences in consistency, colour and cost.

- For our home-made versions we have chosen the ingredients given in the name of the commercial baby food. This means that, unlike some of the commercially prepared foods, our home-made versions are not predominantly apple or pear purée.
- In many cases, the most expensive ingredients were those we used in the greatest amounts, so the prices are not directly comparable. If we had recreated the dishes as per the manufacturers' ingredients list, they would have been much cheaper.
- You can see differences in colour and consistency when different ingredients are used, and freshly prepared foods tasted more authentic, with detectable flavours.

Small bowl
Width: 8cm

Depth: 3cm

The meals marketed as first foods on pages 71-73 are all shown in this size bowl.

In each of our home-made versions, we have shown in bold the most expensive ingredient.

Ella's Kitchen

Broccoli, pears and peas

Organic

COST
40g = 37p

Pears (79%), peas (14%) broccoli (7%), dash lemon juice

Home-made

Broccoli, pears and peas

Organic

COST
40g = 15p

Broccoli (50%), pears (30%), peas (20%)

Ella's Kitchen

Peas, peas, peas

Organic

COST
40g = 46p

Peas (50%), water (50%)

Home-made

Peas, peas, peas

Organic

COST
40g = 28p

(If 50% peas used, cost = 16p)

Peas (90%), water (10%)

Heinz

Apple and strawberry purée

COST 40g = 36p

Apple purée concentrate (90%), strawberry (10%,) lemon juice, vitamin C

Home-made

Apple and strawberry

COST 40g = 24p

Apple (50%), **strawberry** (50%)

Heinz

Mango, banana and lime

COST 40g = 36p

Apple purée (63%), mango (20%), banana (13%), lime juice (4%)

Home-made

Mango, banana and lime

COST 40g = 18p

Mango (50%), banana (40%) lime juice (10%)

Cow & Gate

Juicy apple and mango

COST
40g = 21p

Apple purée (60%), mango (20%), banana (14%) water, rice flour concentrated lemon juice, vitamin C

Home-made

Apple and mango

COST
40g = 18p

Apple 50%, **mango** 50%

Hipp Organic

Parsnips, sweet potato and broccoli

Organic

COST
40g = 40p

Parsnips (35%) water, sweet potato (20%), potato (8%), broccoli (8%), rapeseed oil (1.6%)

Home-made

Parsnips, sweet potato and broccoli

Organic

COST
40g = 18p

Parsnips (40%) sweet potato (30%), broccoli (30%)

Meals for 6 months +

Key points

- Water was not used in any of our dishes, but we used milk to allow a mashed texture to be achieved where needed. The high water content of some commercial foods meant that a much smaller portion size of a home-made food was needed to provide the same energy content.
- The difference in main ingredients used is also striking. For example, our dish of 'Cauliflower cheese and butter beans' had 45% cauliflower and 16% butter beans, whereas the commercial version has 15% cauliflower and 5% butter beans. Our chicken, turkey and lamb dinners had 25% chicken or turkey and 20% lamb respectively, compared to 13% chicken, 9% turkey and 10% or 8% lamb in the commercial versions.
- The high volumes of food provided in some commercial meals might be difficult for an infant to manage. The difference in volume of food needed is shown in the photographs.

Bowl
Width: 12cm

The meals marketed for 6 months +, and 9 months +, and the desserts, on pages 74-83 are all shown in this size bowl.

In each of our home-made versions, we have shown in bold the most expensive ingredient.

Heinz

Sunday chicken dinner

COST per portion £1.20

1 portion (130g) = 81kcal

Vegetables: parsnip (16%), carrot (12%), potato (8%), tomato (7%), (sweet potato, swede, peas 16%), water, chicken (13%), cornflour, sunflower oil, iron sulphate

Home-made

Sunday chicken dinner

COST per portion 21p

1 portion (100g) = 81kcal

Potato (35%), carrot (30%), **chicken** (25%), broccoli (20%), milk (20%)

Ella's Kitchen

Zingy lamb and couscous with mangoes and raisins

Organic

COST per portion £1.39

1 portion (130g) = 74kcal

Vegetable stock (34%), carrots (14%), lamb (10%), tomatoes (9%), mangoes (8%), butternut squash (8%), green beans (6%), onions (5%), cous cous (4%), raisins (2%), garlic (<1%), mixed spices (<0.2%), (cumin, cinnamon, cloves), peppercorns (<0.1%)

Home-made

Lamb and couscous with mangoes and raisins

Organic

COST per portion 28p

1 portion (54g) = 74kcal

Cous cous (30%), **lamb** (20%), butternut squash (15%), milk (15%), mango (15%), raisins (5%), spices (<1%)

Heinz

Lamb and winter veggies

COST per portion 78p

1 portion (200g) = 126kcal

Water, carrot (16%), swede (5%), (potato, onion 8%), apple juice from concentrate and purée (22%), lamb (8%), cornflour, sunflower oil, natural flavourings, iron sulphate

Home-made

Lamb and winter veggies

COST per portion 23p

1 portion (150g) = 126kcal

Potato (25%), carrot (25%), **lamb** (20%), swede (20%), milk (10%)

Cow & Gate

Garden pea and turkey pie

COST per portion 80p

1 portion (200g) = 140kcal

Water, peas (20%), potato (15%), turkey (9%), pumpkin, tomato purée, courgette, onion, starch, rapeseed oil, celery, lemon juice

Home-made

Pea and turkey pie

COST per portion 30p

1 portion (150g) = 140kcal

Peas (25%), **turkey** (25%), potato (35%), milk (15%)

Ella's Kitchen

Cauliflower cheese and butter beans

Organic

COST per portion £1.30

Stock (44%), potato (19%), cauliflower (15%), milk (15%) cheese (6%), butter beans (5%)

1 portion (120g) = 84kcal

Home-made

Cauliflower cheese and butter beans

Organic

COST per portion 23p

Cauliflower (45%), milk (30%), butter beans (16%) cheese (8%), cornflour (1%)

1 portion (75g) = 84kcal

Meals for 9 months +

Key points

- These commercial meals still have a high water content and therefore smaller amounts of all the main ingredients indicated in the dish name. In our home-made versions we used no water, but added milk where needed to moisten the recipe for mashing.
- We added sweetness to our 'Sweet and sour chicken' with some canned pineapple canned in juice; the commercial version uses about twice as much apple juice.
- We used 25% tuna in our home-made 'Courgette and tuna pasta', compared to 9% in the commercial version.
- The consistency of most commercial foods for this age range remains very soft, and the taste bland, with individual flavours difficult to distinguish.

In each of our home-made versions, we have shown in bold the most expensive ingredient.

HiPP Organic

Sweetcorn, pepper and chicken risotto

Organic

COST per portion 95p

1 portion (200g) = 150kcal

Vegetables (42%) [carrots, sweetcorn (6%), onions, pepper (4%)], water, cooked rice (20%), chicken (8.4%), rapeseed oil (0.8%), herbs, spices (lovage, pepper)

Home-made

Chicken, sweetcorn and pepper risotto

Organic

COST per portion 60p

1 portion (150g) = 150kcal

Cooked rice (40%), sweetcorn (15%), pepper (15%), **chicken** (15%), milk (15%)

Ella's Kitchen

Wonderfully warming beef stew with spuds

Organic

COST per portion £1.89

1 portion (190g) = 91kcal

Vegetable stock 34%, potatoes 22%, carrots 22%, beef 11%, tomatoes 5%, parsnips 4%, cornflour 1%, mixed herbs <1% (thyme, parsley, marjoram, basil, rosemary), peppercorns <1%

Home-made

Beef stew with potatoes

Organic

COST per portion 47p

1 portion (120g) = 91kcal

Beef (26%), potato (26%), carrot (18%), parsnip (18%), tomato purée (5%), milk (5%)

Cow & Gate

Sweet potato mash and chicken

COST per portion £1.60

1 portion (230g) = 155kcal

Vegetables (40%) (sweet potato (20%), carrot, onion, peas, green beans, spinach), water, potato, chicken (8%), corn starch, vegetable oils (rapeseed, sunflower), garlic, thyme

Home-made

Sweet potato and chicken

COST per portion 46p

1 portion (130g) = 155kcal

Sweet potato (50%), **chicken** (45%), milk (5%)

Heinz

Sweet and sour chicken

COST per portion £1.65

1 portion (180g) = 154kcal

Vegetables (45%, tomato, carrot, onion, potato, red pepper (5%)), apple juice from concentrate, rice (18%), chicken (8%), cornflour, sunflower oil, iron sulphate

Home-made

Sweet and sour chicken

COST per portion 37p

1 portion (150g) = 154kcal

Rice (30%), **chicken** (20%), carrot (10%), pepper (10%), onion (10%), tomato (10%), pineapple (10%)

Cow & Gate

Courgette and tuna pasta

COST per portion £1

1 portion (250g) = 173kcal

Vegetables (32%) (courgette, carrot, onion), tomato purée, pasta (contains gluten) (20%), water, tuna (fish) (9%), corn starch, rapeseed oil, oregano

Home-made

Courgette and tuna pasta

COST per portion 61p

1 portion (180g) = 173kcal

Pasta (40%), **tuna** (25%), courgette (25%), tomato purée (5%), onion (5%)

Desserts for 4-36 months

Key points

- Desserts are generally marketed across the infant age range, for 4-36 months, 4 months +, or 6 months +.
- Many of the desserts marketed have added sugar, but the taste remains bland. We did not use sugar in any of our desserts, but they still had much better taste profiles than the commercial versions.
- Our home-made 'Chocolate pudding', made from custard and cocoa powder, had a fruity, chocolatey taste without sweetness and was incomparable to the commercial chocolate pudding.
- The desserts were very cost-effective to make, even using our more expensive ingredients, such as fruit, in greater amounts.
- Desserts can be a useful way of adding additional tastes to meals, but large amounts of bland, sweet foods that are low in important nutrients are an unhelpful addition to the complementary diet.

In each of our home-made versions, we have shown in bold the most expensive ingredient.

Cow & Gate

Egg custard

COST per portion 65p

Skimmed milk (30%), full cream milk (30%), rice (29%), sugar, water, egg (3%), nutmeg (0.1%)

1 portion (125g) = 98kcal

Home-made

Egg custard

COST per portion 13p

Milk (70%), **egg** (30%), nutmeg (0.1%)

1 portion (110g) = 98kcal

HiPP Organic

Banana custard

Organic

COST per portion 85p

Whole milk (70%), water, sugar, banana (4%), rice starch, ground rice

1 portion (125g) = 114kcal

Home-made

Banana custard

Organic

COST per portion 19p

Banana (50%), whole milk (47%), custard powder (3%)

1 portion (120g) = 114kcal

Heinz

Chocolate pudding

COST per portion 33p (multi-pack)

Milk (79%), water, sugar, cornflour, cocoa powder

1 portion (120g) = 100kcal

Home-made

Chocolate pudding

COST per portion 8p

Milk (85%), custard powder (5%), cocoa powder (5%)

1 portion (95g) = 100kcal

Cow & Gate

Rice pudding

Full cream milk (54%), rice (34%), water, sugar

COST per portion 80p

1 portion (200g) = 189kcal

Home-made

Rice pudding

Whole milk (55%), rice (45%)

COST per portion 7p

1 portion (160g) = 189kcal

Cow & Gate

Fruity crumble

Apple (32%), banana (30%), water, orange juice (14%), biscuit (6%), whey powder

COST per portion 80p

1 portion (200g) = 158kcal

Home-made

Apple crumble

Apple (65%), flour (15%), milk (15%), butter (5%)

COST per portion 38p

1 portion (125g) = 158kcal

Advice for health professionals

Health visitors, midwives, nursery nurses, child care workers, public health nutritionists, dietitians, GPs, paediatricians and other health workers may be asked their opinion about how useful commercial baby foods are in the diets of infants aged under 1 year. Evidence suggests that families use these products primarily because they are convenient, but may also use them because they lack skills in food preparation, have limited knowledge on what foods to offer their infants, or feel that commercial baby foods are safer products. Some families may have limited resources for food preparation and food storage.

Based on the findings in this report we have put together some frequently asked questions about commercial baby foods that you may find useful when supporting families. For more practical and pictorial information about how to support eating well in the first year of life see our resource *Eating well: The first year* at www.firststepsnutrition.org.

Frequently asked questions about commercial baby food

Q Should I recommend families use pouches or jars of puréed fruit and vegetables when introducing solids?

A *Fruit- and vegetable-based commercial baby foods marketed for the introduction of solids are sweet and soft, and because they have been heat-treated and highly macerated, they are high in sugar. They are also very expensive for a small amount of a mashed fruit or vegetable. It is easy to make a small amount of smooth or mashed fruit or vegetable baby food from raw or cooked foods, and a small amount of baby's milk can be used to soften these if needed.*

Raw foods that can be simply prepared include: banana, avocado, ripe pears, raspberries, strawberries, mango (frozen fruit or fruit canned in juice can be used).

Foods that need to be cooked first but which are easily prepared include: potato, sweet potato, courgette, spinach, butternut squash, pumpkin, carrot, parsnip, canned tomatoes. Frozen vegetables and vegetables canned without salt added can be used.

Babies from 6 months can also have finger foods of soft vegetables and fruits.

Q If families lack confidence in preparing food for their baby, should I recommend they start with pouches and jars?

A *If families lack confidence in preparing food, this is going to impact on how they feed this baby, and other family members. Feeding a baby with simple unprocessed or minimally processed foods is the best place to start gaining confidence. Show families pictures of simple family foods they can offer their baby and how they can use suitable foods they buy for their own meals so that baby food is not an added expense. Examples of family meals that can be adapted for infants and young children can be found in our* Eating well: recipe book, *available at www.firststepsnutrition.org*

Q Are babies less likely to choke when given soft purées in pouches and jars?

A *Make sure that everyone in a household knows that the most important thing when feeding a baby is that they are never left alone when eating, whatever food is being given. Babies should also be in a sitting position when food is offered, and should not be given food lying down. There is no evidence that infants fed with a more baby-led approach (which offers a variety of textures) choke any more than infants fed soft foods. Advice on how to minimise choking risk and on which foods to avoid is important for all families, but relying on soft commercial purées alone will not support a baby learning to handle food in the mouth and manage swallowing.*

Q If families have limited equipment or lack a safe space to prepare food, aren't jars and pouches of baby food the safest foods to recommend?

A *Health workers will use their own judgement when working with families in more difficult circumstances about what the appropriate advice is on how to feed a baby. Pouches and jars of baby food are, however, very expensive and may be a burden on a family budget, so discussion about food eaten by other family members and how this might be adapted for their baby is worth consideration. Whatever food is offered, attention needs to be given to the environment and feeding equipment the baby is exposed to, to ensure they are safe.*

Q Are the amounts in jars and pouches the right amount for a baby meal, so that babies should be encouraged to eat all of it?

A *The sizes of jars and pouches and the nutritional content of the product they hold are not based on an amount of energy (calories) or nutrients that an infant needs. Always feed a baby responsively, following baby's cues to know when they have had enough, and never force an infant to eat. Commercial foods often have a high water content and the portion sizes can be large. Offering home-made foods allows more energy- and nutrient-dense foods to be given, and more appropriate portion sizes. Examples of simple home-made baby foods are shown on pages 71-83.*

Q Are commercial foods in jars and pouches more nutritious?

A *Commercial baby foods in jars and pouches often have a higher water content than home-made foods, and typically they have smaller amounts of some of the more nutritious ingredients compared to home-made foods. Care-givers are paying a lot of money for the convenience of having food ready to serve. You can use some of the example photos on pages 71-83 to show differences between home-made and commercial dishes.*

Q Is it a problem if babies suck directly from a pouch nozzle?

A *Allowing babies to suck directly from a pouch means they have no idea what they are eating, and that sweet foods will spend longer on the teeth and may impact on oral health. It also changes eating from a chewing to a sucking activity. This should be discouraged at all ages.*

Q Aren't pouches and jars convenient when families are out and about?

A *Occasional use of baby foods in jars and pouches is not harmful, but it is useful for families to reflect on how their baby typically eats and how often they may be eating on the move and whether this is ideal. What happens on 'high days and holidays' is less important than what happens routinely, where home-prepared baby foods are always preferable.*

Q Do foods with multiple blended ingredients help infants to learn about more new flavours?

A *Lots of commercial baby foods muddle up flavours, and sweeten savoury tastes, and this does not help babies to recognise and learn to enjoy a range of flavours. It is important that infants learn to recognise different foods by their appearance, colour and flavour, and providing blended commercial foods makes this difficult.*

Appendix
Compositional regulations

This Appendix contains key points from the *Processed Cereal-based Foods and Baby Foods for Infants and Young Children (England) Regulations 2003*. The full version can be accessed from:
http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=URISERV:l21101a&from=EN

Labelling regulations

Labels must include:

- The age from which the product may be used, which must not be less than 4 months. Products recommended for from the age of 4 months may indicate that they are suitable from that age unless persons having qualifications in medicine, nutrition etc. advise otherwise.
- The presence or absence of gluten if the indicated age from which the product may be used is below 6 months.
- The available energy value (in kJ and kcal), and the protein, carbohydrate and lipid content (in numerical form) per 100g or 100ml of the product as sold and, where appropriate, per specified quantity of the product as proposed for consumption.
- The average quantity of each mineral substance and of each vitamin governed by a specific level in Annex I and Annex II respectively, expressed in numerical form, per 100g or 100ml of the product as sold and, where appropriate, per specified quantity of the product as proposed for consumption.
- Instructions for appropriate preparation, when necessary, and a statement as to the importance of following those instructions.

The labelling may include the following non-mandatory particulars:

- The average quantity of the nutrients set out in Annex IV (in numerical form) per 100g or 100ml of the product as sold and, where appropriate, per specified quantity of the product as proposed for consumption.
- Information on vitamins and minerals shown in Annex V (as a percentage of the reference values given therein) per 100g or 100ml of the product as sold, and where appropriate, per specified quantity of the product as proposed for consumption, provided that the quantities present are at least equal to 15% of the reference values.

Compositional regulations

The requirements concerning nutrients refer to the products ready for use, marketed as such or reconstituted as instructed by the manufacturer.

1. Protein

1.1. If meat, poultry, fish, offal or other traditional source of protein are the only ingredients mentioned in the name of the product, then:

- the named meat, poultry, fish, offal or other traditional protein source, in total, shall constitute not less than 40% by weight of the total product,
- each named meat, poultry, fish, offal or other traditional source of protein shall constitute not less than 25%, by weight, of total named protein sources,
- the total protein from the named sources shall not be less than 1.7g/100kJ (7g/100kcal).

1.2. If meat, poultry, fish, offal or other traditional source of protein, singularly or in combination, are mentioned first in the name of the product, whether or not the product is presented as a meal, then:

- the named poultry, fish, offal or other traditional protein source, in total, shall constitute not less than 10% by weight of the total product,
- each named meat, poultry, fish, offal or other traditional source of protein shall constitute not less than 25% by weight, of total named protein sources,
- the protein from the named sources shall not be less than 1g/100kJ (4g/100kcal).

1.3. If meat, poultry, fish, offal or other traditional source of protein, singularly or in combination are mentioned, but not first, in the name of the product, whether or not the product is presented as a meal, then:

- the named meat, poultry, fish, offal or other traditional protein source, in total, shall constitute not less than 8% by weight of the total product,

- each named meat, poultry, fish, offal or other traditional source of protein shall constitute not less than 25%, by weight, of total named protein sources,
- the protein from the named sources shall not be less than 0.5g/100kJ (2.2g/100kcal),
- the total protein in the product from all sources shall not be less than 0.7g/100kJ (3g/100kcal).

1.4. If cheese is mentioned together with other ingredients in the name of a savoury product, whether or not the product is presented as a meal, then:

- the protein from the dairy sources shall not be less than 0.5g/100kJ (2.2g/100kcal),
- the total protein in the product from all sources shall not be less than 0.7g/100kJ (3g/100kcal).

1.5. If the product is designated on the label as a meal, but does not mention meat, poultry, fish, offal or other traditional source of protein in the name of the product, the total protein in the product from all sources shall not be less than 0.7g/100kJ (3g/100kcal).

1.6. Sauces presented as an accompaniment to a meal shall be exempt from the requirements of points 1.1 to 1.5 inclusive.

1.7. Sweet dishes that mention dairy products as the first or only ingredient in the name shall contain not less than 2.2g dairy protein/100kcal. All other sweet dishes shall be exempt from the requirements in 1.1 to 1.5.

2. Carbohydrates

The quantities of total carbohydrates present in fruit and vegetable juices and nectars, fruit-only dishes, and desserts or puddings shall not exceed:

- 10g/100ml for vegetable juices and drinks based on them,
- 15g/100ml for fruit juices and nectars and drinks based on them,
- 20g/100g for fruit-only dishes,
- 25g/100g for desserts and puddings,
- 5g/100g for other non-milk-based drinks.

3. Fat

3.1. For products referred to in point 1.1:

If meat or cheese are the only ingredients or are mentioned first in the name of a product, the total fat in the product from all sources shall not exceed 1.4g/100kJ (6g/100kcal).

3.2. For all other products, the total fat in the product from all sources shall not exceed 1.1g/100kJ (4.5g/100kcal).

4. Sodium

4.1. The final sodium content in the product shall be either not more than 48mg/100kJ (200mg/100kcal) or not more than 200mg per 100g. However if cheese is the only ingredient mentioned in the name of the product, the final sodium content in the product shall not be more than 70mg/100kJ (300mg/100kcal).

4.2. Sodium salts may not be added to products based on fruit, nor to desserts or puddings except for technological purposes.

5. Vitamins

Vitamin A shall not be added to baby foods other than vegetable juices.

Vitamin D shall not be added to baby foods.

References

Afflerback S, Carter SK, Anthony AK, Grauerholz L (2013). Infant feeding consumerism in the age of intensive mothering and risk society. *Journal of Consumer Culture*, online DOI: 10.1177/1469540513485271.

Agostoni C, Decsi T, Fewtrell M, et al (2008). Complementary feeding: a commentary by the ESPGHAN Committee on Nutrition. *Journal of Pediatric Gastroenterology and Nutrition*, 46, 99-110.

Apple RD (1995). Constructing mothers: Scientific motherhood in the nineteenth and twentieth centuries. *Medicine and Health*, 8, 161-178.

Barends C, De Vries J, Mojet J, et al (2013). Effects of repeated exposure to either vegetables or fruits on infants' vegetable and fruit acceptance at the beginning of weaning. *Food Quality and Preference*, 29, 157-165.

Bentley A (2014). *Inventing Baby Food*. California: University of California Press.

Birch LL, Gunder L, Grimm-Thomas K, et al (1998). Infants' consumption of a new food enhances acceptance of similar foods. *Appetite*, 30, 283-295.

British Medical Association. BMA Board of Science (2013). *Growing up in the UK*. Available at: http://www.bma.org.uk/growingupintheuk

Brown A, Harries V (2015). Infant sleep and night feeding patterns during later infancy: association with breastfeeding frequency, daytime complementary food intake, and infant weight. *Breastfeeding Medicine*, 10, 246-252.

Brown A, Rowan H (2015). Maternal and infant factors associated with reasons for introducing solid foods. *Maternal and Child Nutrition*. Article first published online: 26 Feb 2015. DOI: 10.1111/mcn.12166

Carstairs SA, Marais D, Craig LCA, Kiezebrink K (2015). Seafood inclusion in commercial main meals early years' food products. *Maternal and Child Nutrition*, epub ahead of publication.

Center for Science in the Public Interest (2015). *Plum Organics, Gerber accused of bait-and-switch schemes on baby food labels*. Available at: https://cspinet.org/article/plum-organics-gerber-accused-bait-and-switch-schemes-baby-food-labels

Chambers L (2016). Complementary feeding: vegetables first, frequently and in variety. *Nutrition Bulletin*, 41, 142-146.

Cichero J (2016). Introducing solids foods using baby-led weaning vs. spoon feeding: a focus on oral development, nutrient intake and quality of research to bring balance to the debate. *Nutrition Bulletin*, 41, 72-77.

Clifford RI, Head J, Kinjanjui J, Talbott M (2014). Quantification of natural sugars in baby food products by MID FTIR spectroscopy. *Application News*, No. SSI-FTIR-1401.

Department of Health (1991). *Dietary Reference Values for Food Energy and Nutrients for the United Kingdom*. London: HMSO.

Department of Health (1994). *Weaning and the Weaning Diet. Report on Health and Social Subjects No. 45*. London: HMSO.

Department of Health (2004). *Recommendations on Breastfeeding Duration and Weaning*. London: HMSO.

Drewnowski A, Mennella JA, Johnson SL, Bellisle F (2012). Sweetness and food preference. *Journal of Nutrition*, 142, 6, 1142-1148.

Dunford E, Louie JCY, Byrne R, et al (2015). The nutritional profile of baby and toddler food products sold in Australian supermarkets. *Maternal and Child Health Journal*, 19 (12), 2598-2604.

EFSA (2009). Scientific Opinion on the appropriate age for introduction of complementary feeding of infants. *EFSA Journal*, 7 (12), 1423-42.

EFSA (2011). Scientific Opinion on the substantiation of a health claim related to alpha linolenic acid and contribution to brain and nerve tissue development pursuant to Article 14 of Regulation (EC) No 1924/2006. *EFSA Journal*, 9, 4. Available at: http://onlinelibrary.wiley.com/doi/10.2903/j.efsa.2011.2130/abstract

EFSA (2013a). Commission recommendation on acrylamide in food. *Official Journal of the EU*, 2013/647/EU. Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:301:0015:0017:EN:PDF

EFSA (2013b). EFSA NDA Panel (EFSA Panel on Dietetic Products, Nutrition and Allergies). Scientific Opinion on nutrient requirements and dietary intakes of infants and young children in the European Union. *EFSA Journal*, 11 (10), 3408. doi:10.2903/j.efsa.2013.3408

Elliott CD (2011). Sweet and salty: nutritional content and analysis of baby and toddler foods. *Journal of Public Health*, 33, 63-70.

Elliott CD, Conlon MJ (2014). Packaged baby and toddler foods: questions of sugar and sodium. *Pediatric Obesity*, 10, 149-155.

Fangupo LJ, Heath ALM, Williams SM, et al (2016). A baby-led approach to eating solids and risk of choking. *Pediatrics*, 138, 1-9.

Fildes A, Lopes C, Moreirea P, et al (2015). An exploratory trial of parental advice for increasing vegetable acceptance in infancy. *British Journal of Nutrition*, 114, 328-336.

Finglas PM, Rose MA, Pinchen HM, et al (2015). *McCance and Widdowson's The Composition of Foods, Seventh summary edition*. Cambridge: Royal Society of Chemistry.

Food Standards Agency (2017). *Survey of acrylamide and furan in UK retail products*. London: Food Standards Agency. Available at: https://www.food.gov.uk/sites/default/files/acrylamide-furan-report.pdf

Fuentes M, Brembeck H (2016). Best for baby? Framing weaning practice and motherhood in web-mediated marketing. *Consumption Markets and Culture*. Accessed from: http://www.tandfonline.com/doi/abs/10.1080/10253866.2016.1205493

Garcia AL, Raza S, Parrett A, Wright CM (2013). Nutritional content of infant commercial weaning foods in the UK. *Archives of Disease in Childhood*, 98, 793-797.

Garcia AL, McLean K, Wright CM (2015). Types of fruits and vegetables used in commercial infant foods and their contribution to sugar content. *Maternal and Child Nutrition*, 12, 4, 838-847.

Gerrish CJ, Mennella JA (2001). Flavor variety enhances food acceptance in formula-fed babies. *American Journal of Clinical Nutrition*, 73, 1080-1085.

Grimshaw KE, Maskell J, Oliver EM, et al (2014). Diet and food allergy development during infancy: birth cohort study findings using prospective food diary data. *Journal of Allergy and Clinical Immunology*, 133, 511-519.

Harris G, Coulthard H (2016). Early eating behaviours and food acceptance revisited: breastfeeding and introduction of complementary foods as predictive of food acceptance. *Current Obesity Reports*, 5, 113-120.

Hieke S, Kuljanic N, Pravst I, et al (2016). Prevalence of nutrition and health-related claims on pre-packaged foods: A five-country study in Europe. *Nutrients*, 8, 3, 107. doi: 10.3390/nu8030137

IGD (2014). *Best Practice Guide to Calculating and Communicating Fruit and Vegetable Portions in Composite Foods*. Available at: http://www.igd.com/Research/Nutrition-food-and-farming/Calculating-and-communicating-fruit-and-vegetable-portions-in-composite-foods/

Kanciruk M, Andrews JW, Donnon T (2014). Family history of obesity and risk of childhood overweight and obesity: a meta-analysis. *International Scholarly Science and Innovation*, 8, 261-273.

Karjalainen S, Soderling E, Sewon L, et al (2001). A prospective study on sucrose consumption, visible plaque and caries in children from 3 to 6 years of age. *Community Dentistry and Oral Epidemiology*, 29, 136-142.

Kocadagh T, Gökmen V (2014). Investigation of α-dicarbonyl compounds in baby foods by high performance liquid chromatography coupled with electrospray ionisation mass spectrometry. *Agricultural and Food Chemistry*, 62, 7714-7720.

Koski A, Psomiadou E, Tsmiidou, et al (2002). Oxidative stability and minor constituents of virgin olive oil and cold-pressed rapeseed oil. *European Food Research and Technology*, 214, 294-298.

Lange C, Visallis M, Jacob S, et al (2013). Maternal feeding practices during the first year and their impact on infants' acceptance of complementary food. *Food Quality and Preference*, 29, 89-98.

Lennox A, Sommerville J, Ong K, et al, Department of Health and FSA. (2013). *Diet and Nutrition Survey of Infants and Young Children 2011*. Available at https://www.gov.uk/government/publications/diet-and-nutrition-survey-of-infants-and-young-children-2011

Liang G, Wang F, Song X, et al (2016). 3-Deoxyglucosone induces insulin resistance by impairing insulin signalling in HepG2 cells. *Molecular Medicine Reports*, 13, 4506-4512.

Loughrill E, Zand N (2015). An investigation into the fatty acid content of selected fish-based commercial infant foods in the UK and the impact of commonly practiced re-heating treatments used by parents in the preparation of infant formula milks. *Food Chemistry*, 197, 783-789.

Loughrill E, Govinden P, Zand N (2016a). Vitamins A and E content of commercial infant foods in the UK: a cause for concern? *Food Chemistry*, 210, 56-62.

Loughrill E, Wray D, Christides T, Zand N (2016b). Calcium to phosphorus ratio, essential elements and vitamin D content of infant foods in the UK: possible implications for bone health. *Maternal and Child Nutrition*: online. DOI: 10.1111/mcn.12368.

Lundy BFT, Carraway K, Hart S, et al (1998). Food texture preferences in infants versus toddlers. *Early Child Development and Care*, 146, 69-85.

MacNeill NM (1943). Infant feeding in a rationed era. *Pennsylvania Medical Journal*, 47, 209-211.

Maier A, Chabanet C, Schaal B, et al (2007). Effects of repeated exposure on acceptance of initially disliked vegetables in 7-month old infants. *Food Quality and Preference*, 18, 1023-32.

Maslin K, Galvin AD, Shephard S, et al (2015). A qualitative study of mothers' perception of weaning and the use of commercial infant food in the United Kingdom. *Maternal and Pediatric Nutrition Journal*. Journal, 1, 1.

McAndrew F, Thompson J, Fellows L, et al (2012). *Infant Feeding Survey 2010*. Leeds: Health and Social Care Information Centre.

Mennella JA (2014). Ontogeny of taste preferences: basic biology and implications for health. *American Journal of Clinical Nutrition*, 99 (suppl), 704S-711S.

Mesch CM, Stimming M, Fotorek K, et al (2014). Food variety in commercial and homemade complementary meals for infants in Germany: market survey and dietary practice. *Appetite*, 76, 113-119.

Mintel (2016). Baby Food and Drink: *Mintel Marketing Report, April 2016*.

Neilson (2015). *Trends in the Global Baby Food and Diaper Markets* (August 2015). Available at: http://www.nielsen.com/content/dam/nielsenglobal/de/docs/Nielsen%20Global%20Baby%20Care%20Report%20-%20August%202015.pdf

NHS Choices (2016). Available at: http://www.nhs.uk/conditions/pregnancy-and-baby/pages/solid-foods-weaning.aspx

Okubo H, Crozier SR, Harvey NC, et al (2015). Diet quality across early childhood and adiposity at 6 years: the Southampton Women's Survey. *International Journal of Obesity*, 39, 1456-1462.

Pan American Health Organization / WHO (2001). *PAHO/WHO Guiding Principles for Complementary Feeding of the Breastfed Child*.

Pimpin L, Jebb S, Johnson L, et al (2016). Dietary protein is associated with body mass index and weight up to 5 y of age in a prospective cohort of twins. *American Journal of Clinical Nutrition*, 103, 389-397.

Rapley G (2016). Are puréed foods justified for infants of 6 months? What does the evidence tell us? *Journal of Health Visiting*, 4, 289-295.

Remy E, Issanchou S, Chabanet C, et al (2013). Repeated exposure of infants at complementary feeding to a vegetable purée increases acceptance as effectively as flavour-learning and more effectively that flavour-nutrient learning. *The Journal of Nutrition*, 143, 1194-1200.

Rudd Center for Food Policy and Obesity (2016). *Baby Food Facts*. Accessed at http://www.uconnruddcenter.org/babyfoodFACTS.

SACN (2013). *Salt and Health*. Available at: https://www.gov.uk/government/publications/sacn-salt-and-health-report

SACN (2015). *Carbohydrates and Health*. London: The Stationery Office. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/445503/SACN_Carbohydrates_and_Health.pdf

SACN (2016). Minutes of meeting 30th June 2016. https://app.box.com/s/qv74594fo7mwxgsqbrvc5fdbrycchma4/1/8429053429/77229943237/1

Smith HA, Becker GE (2016). Early addition of foods and fluids for healthy breastfed term infants. *Cochrane Database of Systematic Reviews*, Issue 8, Art No CD006462.

Start4Life (2016). https://www.nhs.uk/start4life/first-foods

Vos MB, Kaar JL, Welsh JA, et al (2016). Added sugars and cardiovascular disease risk in children. A scientific statement from the American Heart Association. *Circulation*, 134, 1-13.

Walker R, Goran M (2015). Laboratory determined sugar content and composition of commercial infant formulas, baby foods and common grocery items targeted to children. *Nutrients* 7 (7), 5850-5867.

WHO (2003). *Global Strategy for Infant and Young Child Feeding*. Available at http://www.who.int/nutrition/publications/infantfeeding/9241562218/en/

Wilson CE, Brown WE (1997). Influence of food matrix structure and oral breakdown during mastication on temporal perception of flavor. *Journal of Sensory Studies*, 12, 69-86.

Zand N, Chowdhry BZ, Zotor FB, et al (2011). Essential and trace elements content of commercial infant foods in the UK. *Food Chemistry*, 128, (1), 123-128.

Zand N, Chowdhry BZ, Pollard LV, et al (2012a). Commercial 'ready-to-feed' infant foods in the UK: macro-nutrient content and composition. *Maternal and Child Nutrition*, 11, 2, 202-214.

Zand N, Chowdhry BZ, Wray DS, et al (2012b). Elemental content of commercial 'ready-to-feed' poultry and fish based infant foods in the UK. *Food Chemistry*, 135, 4, 2796-2801.

Zand N, Chowdhry BZ, Pullen FS, et al (2012c). Simultaneous determination of riboflavin and pyridoxine by UHPLC/LC–MS in UK commercial infant meal food products. *Food Chemistry*, 135, 2743-2749.

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ISBN 978-1-908924-43-8 Hard copy

ISBN 978-1-908924-44-5 ebook

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