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Review of Guidelines for Infant Feeding in Developed Countries

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Introduction.

Breastfeeding for the first few months of life remains undisputed as the best source of nutrition for infants. Its benefits are numerous and include protection from infectious diseases (both in developed and developing countries) [1-3], improvements in child development and cognition [4-5] and there is accumulating evidence for its effects on protection against chronic diseases such as obesity, diabetes and cancer in later life [6]. In the Global Strategy on Infant and Young Child Feeding (GSIYCF) the World Health Organization recommends exclusive breastfeeding until 6 months of age and continued breastfeeding for at least 2 years, along with adequate amounts of complementary foods of suitable nutritional quality thereafter [7]. In the developed world there is much controversy surrounding this global recommendation for exclusive breastfeeding, because in reality very few women feed their infants according to this guideline. For example less than 1% of infants in the UK are exclusively breastfed to 6 months [8] and although data on exclusive breastfeeding is not available in Australia, data from the Longitudinal Study of Australian Children shows that only 14 % of infants in Australia are fully breastfed to 6 months [9]. Recently there have been calls to reappraise the evidence around this global recommendation for exclusive breastfeeding [10].

Another area of controversy regarding infant feeding is related to the when the introduction of solid foods should occur, what the ideal first foods should be and how these first foods should be introduced. The GSIYCF specifically states that complementary feeding should be introduced at six months when the need for energy and nutrients exceeds that which can be provided through exclusive and frequent breastfeeding. There is very little detail in these guidelines on what food should be fed but they state the importance of nutritional adequacy of the food provided and hygienically storage and preparation. The GSIYCF also refer to two companion documents the Guiding Principles for Complementary Feeding of the Breastfed child [11] and Guiding Principles for Complementary Feeding of the non-breastfed child 6-24 months of age [12] which are reviewed in detail below.

The guidelines for the when to introduce solid foods differ substantially between nations and are often not the same as those contained in the GSIYCF and companion documents. There is sometimes even disagreement among advisory bodies in the same country mainly because, as mentioned above, the recommendation differs greatly from actual practices within countries. Another area where guidelines differ is in recommendations for the introduction of cow's milk and allergenic foods such as eggs and nuts. This paper reviews the evidence surrounding the Global Strategy for Infant and Young Child Feeding, particularly in regard to introduction of solid foods. It also compares these global guidelines with other national policies and guidelines.

Global strategy on infant and young child feeding

In 2003 the World Health Organisation released the Global Strategy for Infant and Young Child Feeding [7]. The development of this recommendation was complex and involved an Expert Consultation on the topic [13] and a WHO commissioned systematic review of the evidence for optimal duration of exclusive breastfeeding [14] which has since been updated [15].

The systematic review was based in the context of public health concerns about the length

of exclusive breastfeeding, 22 studies in total were used 11 from developing and 11 from developed countries. Definitions of exclusive breastfeeding varied among studies. The main question was: should infants who are exclusively breastfed for the first three to four months continue exclusive breastfeeding or receive complementary foods in addition to breastmilk (mixed breastfeeding)?

Therefore studies comparing exclusive breastfeeding and mixed breastfeeding from birth were excluded, as were studies investigated the effects of age at introduction of liquid or solid foods which did not ensure exclusive breastfeeding at least three months prior to their introduction. The main conclusion from this review was that infants who were exclusively breasfed for six months experienced less morbidity from gastrointestinal infection than those who were mixed breastfed from 3-4 mo, and there were no deficits in growth among infants from either developing or developed countries who are exclusively breastfed for six months or longer. The authors state that in developing country settings, were newborn iron and zinc stores are low, iron and zinc supplementation may be necessary [16]. The authors recommend that for 6 months exclusive breastfeeding is a general policy recommendation but they also suggest that infants should still be managed individually so that insufficient growth or other outcomes are not ignored and appropriate interventions are provided. There were some limitations to this review, including that only two studies were randomised trials and both were from Honduras.

Prior to the release of the systematic review the Expert Consultation had noted that a number of observational studies and two randomised trials had not identified any benefits from the introduction of solid foods before the age of 6 months [17-19]. The debate about the timing and exposure to complementary foods was mainly focused around immune function (immuno-tolerance, intestinal function, its microflora and systemic metabolism) [20] and growth. Growth was generally not improved by complementary feeding before 6 months even under optimal conditions and complementary food tended to displace breastmilk (Dewey 1999, and Cohen 1994). At around 6 months an infant’s appetite and nutritional requirements no longer met by breastmilk alone and additional iron and zinc are critical [21-22] and developmentally children are ready for solids. At this time the tongue extrusion reflex stops and behaviour changes from suckling to biting and then to chewing (7-9mo) [21] and children can sit with support so that food can be manipulated before swallowing [23]. Infants become more interested in the environment around them and are more willing to accept new textures and flavours. Physiologically the digestive system also matures and essential amylases like pancreatic amylase (which is not present up to 3 months and inadequate up to 6 months) enables the child to digest starch [24]. The expert consultation outlined the problems of introducing food too early (maternal milk production declines because of reduced stimulation, tongue extrusion reflex still strong and infants immune system and gut still immature) and reviewed evidence from a cohort study in Sweden showed that the younger an infant was when introduced to solids the longer it took for them to establish solid feeding [25]. They also recognised the need to not introduce solid food too late to avoid growth faltering, micronutrient deficiencies and delayed development. They recognised that more research is needed to identify subgroups that require earlier introduction of solids but 6 months is the group recommendation [26]. The Expert Consultation concluded that potential health benefits outweigh any potential risks and most children are developmentally ready for complementary foods at 6 months of age (Naylor and Morrow).

Guiding Principles for Complementary Feeding of the Breastfed Child/ Non Breastfed Child

With the Guiding Principles for Complementary Feeding of the Breastfed Child [27] 10 guiding principles are outlined. Apart from maintaining exclusive breastfeeding for six months and any breastfeeding for two years or beyond they encourage the practice of responsive feeding, applying the principles of psycho-social care (Engle et al., 2000; Pelto et al., 2002) which include being sensitive to children's hunger and satiety cues; not force feeding, experimenting with different food combinations, tastes, textures and methods of encouragement to combat food refusal and minimize distractions. They also give approximate calorie requirements and frequencies for meals. They recommend meat, poultry, fish or eggs should be eaten daily, or as often as possible and recommend fortified products for vegetarians. The Guiding Principles for Complementary Feeding of the non-breastfed child 6-24 months of age [12] are very similar apart from differing calorie requirements depending on non-breastmilk fluid intake. The total energy and therefore meal frequency and energy density requirements are slightly higher in combined formula fed and breastfed infants compared with breastfed infants because in formula fed infants the resting metabolic rate is higher [28-29]. It is interesting to note that neither of these guidelines discourage cow's milk or allergenic foods before the age of one year.

Australian Guidelines

The Dietary Guidelines for Children and Adolescents in Australia which incorporated the Infant Feeding Guidelines for Health Workers was endorsed by the Australia Government in April 2003. They state that exclusive breastfeeding until *around six months* should be the aim for every infant. If that is not possible, mothers should be encouraged to breastfeed as much, and for as long, as they can. They further state that breastfeeding should be continued until at least 12 months. If for any reason breastmilk is discontinued before 12 months of age, a commercial infant formula should be used— instead of cow's milk—as the main source of milk. With regard to solid feeding they recommend the introduction of solid foods *at around 6 months*, to meet the infant's increasing nutritional and developmental needs.

With regard to what should be introduced the Australian Guidelines recommend to start with low- allergenic foods such as single-grain baby cereals; followed by vegetables and fruits and then meats. To prevent iron deficiency, iron-containing foods such as iron-fortified cereals are recommended as the first foods, followed later by foods containing meats and other protein-rich foods. Interestingly the guidelines also have recommendations on how to feed- i.e. add only one food at a time and wait several (ideally five to 10) days before introducing a new food.

US Guidelines

The US is an example of a country where national guidelines and guidelines of specific advisory bodies differ. The Dietary Recommendations for Children and Adolescents: A Guide for Practitioners [30] is a comprehensive document states that breastfeeding should come first for infants as the ideal first nutrition and should try and be maintained for 12 months. The document also includes detailed information about what when and how children

should eat. They recommend that it is important to control when food is available and when it can be eaten (nutrient quality, portion size, snacking, regular meals). They also provide social context for eating behaviour (family meals, role of food in social intercourse) and recommend teaching children about food and nutrition at the grocery store, when cooking meals and to counteract inaccurate information from the media and other influences. They also recommend to teach other care providers (e.g., daycare, babysitters) about what you want your children to eat and to serve as role models and lead by example; ―do as I do‖ rather than ―do as I say‖. They also recommend the participation in regular daily physical activity.

The Start Healthy Feeding Guidelines for Infants and Toddlers [31] endorsed by the American Dietetic Association are older and slightly differ in that they state that a normal, healthy infant's gastrointestinal tract is mature enough to digest complementary foods by 3-4 months of age however developmental skills needed to start complementary foods are not present until 4-6 mo. They state that dietary variety is important and variety of flavours and foods in the first 2 years of life may improve acceptance they also state the importance of varying textures appropriate developmental stages. With regard to nutrients they state that iron and Vitamin D are the most important, meats and iron-fortified cereals are best sources. They state that infants with a strong family history of food allergy should be breastfed for as long as possible (note that these recommendations have now been revised) and should not receive complementary foods until 6 months of age. Interestingly these guidelines were the first to that recommend that the parent provides food and environment, child decides whether and how much to eat with responsive parenting as the core of a healthy feeding relationship. They stress the importance of repeated exposure to new foods to enhance acceptance, and recommend starting solid foods as a single ingredients adding them 2-7 days apart. They also stress the importance of physical activity

European Guidelines

Most European countries have their own individual guidelines but a commentary by the EPSGHAN Committee on Nutrition states that exclusive or full breast-feeding for about 6 months ―is a desirable goal‖ [32]. They state that complementary feeding should not be introduced in any infant before 17 weeks, and all infants should start complementary feeding by 26 weeks. Avoidance or delayed introduction of potentially allergenic foods, such as fish and eggs, has not been convincingly shown to reduce allergies, either in infants considered at risk for the development of allergy or in those not considered to be at risk. During the complementary feeding period, >90% of the iron requirements of a breast-fed infant must be met by complementary foods and these should provide sufficient bioavailable iron. They state that cow's milk is a poor iron source and should not be used as the main drink before 12 months, although small volumes may be added to complementary foods before this time. It is interesting that both in Sweden, Denmark cow's milk can be introduced from 9-10 months. This statement also recommend avioding both early (<4 months) and late (≥7 months) introduction of gluten and to introduce gluten gradually while the infant is still breast-fed because this may reduce the risk of cardiovascular disease, type 1 diabetes mellitus, and wheat allergy. Infants and young children receiving a vegetarian diet should receive a sufficient amount (~500 mL) of milk (breast milk or formula) and dairy products. Infants and young children should not receive a vegan diet.

Table 1 shows how the guidelines on infant feeding in different regions of the world differ with

regard to recommendation for exclusive breastfeeding and continuation of breastfeeding and also in the recommendations surround when, what and how to introduce complementary feeding.

Guidelines	Authority	Duration of EBF	Duration of any breastfeeding	Solid Foods (when)	Solid Foods (what)	Solid Foods (how)	Other
Global Strategy for Infant and Young Child Feeding [7]	WHO & UNICEF	for the first 6 months	up to 2 years of age or beyond	after 6 months	No details but foods should provide sufficient energy, protein and micronutrients to meet nutritional needs Also encourage the use of local low cost foods	Consistent with a child's signs of appetite and satiety, meal frequency and feeding method are suitable for age – active encouragement of self feeding	
Guiding Principles for Complementary Feeding of the Breastfed child [11]	PAHO	From birth to 6 months	until to 2 years of age or beyond	at 6 months of age (180 days)	Variety of foods to ensure that nutrient needs are met. Meat, poultry, fish or eggs should be eaten daily. Vegetarian diets are not recommended but nutrient supplements or fortified products can be used. Vitamin A-rich fruits and vegetables should be eaten daily. Adequate fat content in foods. Avoid tea,	Start with small amounts of food and increase the quantity as the child gets older, while maintaining frequent breastfeeding. Practice responsive feeding. Increase food consistency and variety as the infant gets older, pureed, mashed and semi-solid foods beginning at six months. By 8 months most infants can also eat ―finger foods‖. By 12 transition to family foods	
Guiding Principles for Complementary Feeding of the non- breastfed child 6-24 months of age [12]	World Health Organization. Dept. of Nutrition for Health and Development	N/A	N/A	Not given	Meat, fish or eggs daily Milk 200-400mL per day or 300-500ML if vegetarian Grains and legumes if animal source food are not consumed Sources of calcium every day dairy or fish, soyabeans Vitamin A rich food (list) Adequate fat content if animal source foods not consume 10- 20g fat/day added if animal foods consumed then 5g/day Try	As above	
Dietary Guidelines for Children and Adolescents in Australia which incorporated the Infant Feeding Guidelines for Health Workers [33]	NHMRC (Australia)	around 6 months	Breastfeeding should be continued until at least 12 months	around 6 months	Iron enriched breakfast cereals should be introduced first then vegetables, fruits, meats, poultry and fish added gradually- no set rules about order but they should be energy dense, variety is important	Introduce foods individually (no salt, sugar, flavourings) New foods no more than each 5-10 days to avoid confusing and allergy/ sensitivity Offer variety, Texture appropriate to developmental age, smooth foods first, minced or mashed, then finger foods, by 1 year infant should have progressed to family foods from mashed foods to foods with more texture (e.g. chopped into small	Avoid following foods if family history of allergy: cheese, yogurt, ice- cream, fish and cereal, peanuts No cows milk before 12 months, Avoid honey, tea , nuts, fruit juice,

Guidelines	Authority	Duration of EBF	Duration of any breastfeeding	Solid Foods (when)	Solid Foods (what)	Solid Foods (how)	Other
						attempts)	
Dietary Recommendations for Children and Adolescents: A Guide for Practitioners [30]	American Heart Association and endorsed by the American Academy of Pediatrics	for the first 4-6 months	try to maintain for 12 mo	4-6 months	Introduce ―healthy foods‖ but no specific recommendations for infants (My pyramid site starts for children at 2 years). Delay the introduction of 100% juice until at least 6 mo of age and limit to no more than 4–6 oz/day; juice should only be fed from a cup	Respond to satiety clues and do not overfeed; do not force children to finish meals if not hungry	
Position of the American Dietetic Association: Promoting and Supporting	American Dietetic Association (ADA)	for the first 6 months	at least 12 months	Solid feeding not mentioned in this position statement.	N/A	N/A	
The Start Healthy Feeding Guidelines for Infants and Toddlers [31]	American Dietetic Association	4-6 mo	No recommendation	4-6 months	No accepted sequence, but start solid foods as single ingredients and start at 2-7 days apart	Parent provides food and environment, child decides whether and how much to eat. Responsive feeding and parenting is the core to healthy eating. Repeated exposure to new foods enhances acceptance start with small frequent meals, introduce variety of flavours to enhance acceptance, encourage child to be independent, information	
Food and Nutrition Guidelines for Healthy Infants and Toddlers (Aged 0-2): A background paper [35]	New Zealand Health Department	around 6 months	at least one year of age, or beyond	Around 6 months of age	Iron fortified cereals, pureed vegetables, and fruits (without skins or pips) age appropriate meats, vegetarian alternatives, later choose a variety of nutritious foods from each of the four major food groups, which are: - vegetables and fruit - breads and cereals, including some wholemeal - milk and milk products or suitable alternatives - lean meat, poultry, seafood,	Practice responsive feeding, avoid distractions, positive role modelling at family meals, give the child a choice of healthy foods and do not force to eat, serve small amounts and offer more if child is still hungry	

Guidelines	Authority	Duration of EBF	Duration of any breastfeeding	Solid Foods (when)	Solid Foods (what)	Solid Foods (how)	Other
Complementary Feeding: A Commentary by the EPSGHAN Committee on Nutrition. [32]	European Society for Paediatric Gastroenterolog y, Hepatology and Nutrition	about 6 months	None given	Should not be introduced in any infant before 17 weeks, and all infants should start complementa ry feeding by 26 weeks.	No specific recommendations given	Outlines development of taste and food preferences, especially parents role in food preferences, control and restriction and repeated exposure	Statement was mainly addressing allergies and health effects of complementary feeding on growth, neurodevelopem

References

1. Arifeen, S., et al., *Exclusive breastfeeding reduces acute respiratory infection and diarrhea deaths among infants in Dhaka slums.* Pediatrics, 2001. **108**(4): p. E67.
2. Ip S, C.M., Raman G, Chew P, Magula N, DeVine D, Trikalinos T, Lau J. , *Breastfeeding and Maternal and Infant Health Outcomes in Developed Countries. Evidence Report/Technology Assessment.* . 2007, Agency for Healthcare Research and Quality: Rockville, MD.
3. Duijts, L., M.K. Ramadhani, and H.A. Moll, *Breastfeeding protects against infectious diseases during infancy in industrialized countries. A systematic review.* Maternal and Child Nutrition, 2009. **5**(3): p. 199-210.
4. Oddy, W.H., et al., *Breast feeding and cognitive development in childhood: a prospective birth cohort study.* Paediatric and Perinatal Epidemiology, 2003. **17**(1): p. 81-90.
5. Kramer, M.S., et al., *Breastfeeding and child cognitive development: new evidence from a large randomized trial.* Arch Gen Psychiatry, 2008. **65**(5): p. 578-84.
6. McNiel, M.E., M.H. Labbok, and S.W. Abrahams, *What are the Risks Associated with Formula Feeding? A Re-Analysis and Review.* Birth-Issues in Perinatal Care, 2010. **37**(1): p. 50-58.
7. World Health Organization. and UNICEF., *Global Strategy for Infant and Young Child Feeding*. 2003, Geneva: World Health Organization. 30 p.
8. Bolling, K.G., C.; Hamlyn, B.; Thornton A. , *Infant Feeding Survey 2005*. 2007, The Information Centre.
9. Baxter, J., Cooklin, C., & Smith, J., *Which mothers wean their babies prematurely from full breastfeeding? An Australian cohort study [Abstract].* Acta Paediatrica, 2009. **98**(8): p. 1274-1277.
10. Fewtrell, M., et al., *Six months of exclusive breast feeding: how good is the evidence?* BMJ, 2011. **342**: p. c5955.
11. Dewey, K., *Guiding principles for complementary feeding of the breastfed child.* 2003.
12. World Health Organization. Dept. of Child and Adolescent Health and Development. and World Health Organization. Dept. of Nutrition for Health and Development., *Guiding principles for feeding non-breastfed children 6-24 months of age*. 2005, Geneva: World Health Organization. 40 p.
13. Global Consultation on Complementary Feeding (2001 : Geneva Switzerland), World Health Organization. Dept. of Child and Adolescent Health and Development., and World Health Organization. Dept. of Nutrition for Health and Development., *Complementary feeding : report of the global consultation, and summary of guiding principles for complementary feeding of the breastfed child*. 2003, Geneva: World Health Organization. 24 p.
14. Kramer, M.S. and R. Kakuma, *Optimal duration of exclusive breastfeeding.* Cochrane Database Syst Rev, 2002(1): p. CD003517.
15. Kramer, M.S. and R. Kakuma, *The optimal duration of exclusive breastfeeding: a systematic review.* Adv Exp Med Biol, 2004. **554**: p. 63-77.
16. Zlotkin, S.H. and M.G. Cherian, *Hepatic metallothionein as a source of zinc and cysteine during the first year of life.* Pediatric Research, 1988. **24**(3): p. 326-9.
17. WHO Programme of Nutrition., *Complementary feeding of young children in developing countries : a review of current scientific knowledge*. 1998, Geneva: World Health Organization. 228 p.
18. Dewey, K.G., et al., *Age of introduction of complementary foods and growth of term, low- birth-weight, breast-fed infants: a randomized intervention study in*

Honduras. Am J Clin
Nutr, 1999. **69**(4): p. 679-86.
19. Cohen, R.J., et al., *Promoting exclusive breastfeeding for 4-6 months in Honduras: attitudes of mothers and barriers to compliance.* J Hum Lact, 1999. **15**(1): p. 9-18.
20. Aggett, P.J., *Research priorities in complementary feeding: International Paediatric Association (IPA) and European Society of Paediatric Gastroenterology, Hepatology, and Nutrition (ESPGHAN) workshop.* Pediatrics, 2000. **106**(5): p. 1271.
21. Department of Health and Social Security, *Present day practice in infant feeding: report of a working party on the panel on Child Nutrition, Committee on Medical Aspects of Food Policy*. 1988, HMSO: London.
22. Truswell, A., ed. *ABC of Nutrition*. ed. BMJ. 1992, BMJ: London.
23. Hervada, A.R. and D.R. Newman, *Weaning: historical perspectives, practical recommendations, and current controversies.* Current problems in pediatrics, 1992. **22**(5): p. 223-40; discussion 241.
24. Birkbeck, J., *Weaning; a position statement.* The New Zealand medical journal, 1992. **105**(935): p. 221-4.
25. Hornell, A., Y. Hofvander, and E. Kylberg, *Introduction of solids and formula to breastfed infants: a longitudinal prospective study in Uppsala, Sweden.* Acta paediatrica (Oslo, Norway
: 1992), 2001. **90**(5): p. 477-82.
26. Lanigan, J. and J. Morgan, *New global strategy on infant feeding needs to be flexible.* BMJ (Clinical research ed), 2001. **323**(7313): p. 632.
27. Pan American Health Organization., *Guiding principles for complementary feeding of the breastfed child*. eng fre spa. 2003, Washington, D.C.: Pan American Health Organization. 37
p.
28. Dewey, K.G. and K.H. Brown, *Update on technical issues concerning complementary feeding of young children in developing countries and implications for intervention programs.* Food
and Nutrition Bulletin, 2003. **24**(1): p. 5-28.
29. Butte, N.F., et al., *Energy requirements derived from total energy expenditure and energy deposition during the first 2 y of life.* Am J Clin Nutr, 2000. **72**(6): p. 1558-69.
30. Gidding, S.S., et al., *Dietary recommendations for children and adolescents: A guide for
practitioners.* Pediatrics, 2006. **117**(2): p. 544-559.
31. Butte, N., et al., *The start healthy feeding guidelines for infants and toddlers.* Journal of the American Dietetic Association, 2004. **104**(3): p. 442-454.
32. Agostoni, C., et al., *Complementary feeding: a commentary by the ESPGHAN Committee on Nutrition.* Journal of Pediatric Gastroenterology and Nutrition, 2008. **46**(1): p. 99.
33. National Health and Medical Research Council (Australia), *Dietary guidelines for children
and adolescents in Australia incorporating the Infant feeding guidelines for health workers*. 2003, NHMRC: Canberra.
34. James, D.C. and R. Lessen, *Position of the American Dietetic Association: promoting and supporting breastfeeding.* Journal of the American Dietetic Association, 2009. **109**(11): p. 1926-42.
35. Ministry of Health, N.Z. (2008) *Food and Nutrition Guidelines for Healthy Infants and Toddlers (Aged 0-2): A background paper*

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