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NEWS, VIEWS & INFORMATION FOR NUTRITIONAL PROFESSIONALS

Starting Solids: What's New?

- 2 Starting solids in obesogenic environments
- 4 Insights from mums
- 5 Combating micronutrient deficiencies in low income populations



SYMPOSIUM HIGHLIGHTS

Early childhood nutrition plays an important role in healthy growth and development. Recent research has highlighted its role in determining health outcomes later in life.

For emerging evidence in this topical area, the Dietitians Association of Australia hosted a symposium in October which was sponsored by MLA.

Nutritional concerns relating to both prevention of micronutrient deficiencies in low income populations as well as protective eating behaviour in obesogenic environments were considered.

Whilst nutritional interventions pertinent to these very different situations vary enormously, both rely on achieving effective long-term food-related behaviour change.

The Symposium featured evidence from nutrition research, presented by experts in the field, as well as MLA-commissioned consumer research.

Highlights from the symposium *Starting solids: what's new?* are reported in this issue of *Vital*.

Please continue to send us your feedback.



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Starting solids in obesogenic environments

Professor Lynne Daniels, from Queensland University of Technology, is the lead investigator of NOURISH, a NHMRC study evaluating an early childhood intervention aimed at promoting healthy eating and activity patterns in children under two years of age.

Professor Daniels' study, in collaboration with three other large randomised controlled trials underway in Australia and New Zealand, will form the world's first prospective meta-analysis of obesity prevention trials that commence prior to 12 months of age. It will determine whether promoting healthy eating and activity patterns from infancy reduces the risk of childhood obesity at two years of age.

Food preferences and eating patterns are well established by two years of age, tracking into childhood and probably adulthood, potentially impacting on obesity risk. Establishing healthy habits early in life might therefore avoid the effort of having to undo unhealthy eating behaviour later.

Currently, early childhood feeding guidelines are largely based on health outcomes that relate to growth, energy and micronutrient intake, allergy, and infection. However, few address outcomes that are relevant to developing protective eating behaviours that will equip a child to grow up to eat well and maintain a healthy weight status in an obesogenic environment.

A number of factors affect food intake in early childhood and, ultimately, obesity risk.

Neophobia

The intensity of reluctance to consume new foods seems to change over a child's first years. During the first 4–6 months, infants tend to accept even quite bitter tasting formulae easily. They show moderate levels of neophobia until about 1.5–2 years of age, followed by a significant increase until about five years, and a gradual decrease after.

While food neophobia is genetically predisposed, it can be modified by experience. If an infant is regularly exposed to different foods, the neophobic response is reduced and the child becomes more willing to try unfamiliar foods. Daily exposure to a new food over 10 days during weaning (four to six months) can increase intake 2–3 fold.

A 2008 study by Maier suggests the introduction of variety early in weaning by frequently changing foods, rather than the overall number of different foods to which a child is exposed, plays a greater

role in acceptance of new foods.¹ This is especially so when combined with breastfeeding. However, it is unclear whether this affects longer-term dietary variety.

Food preferences

Not surprisingly, research shows there is a greater intake of liked versus disliked foods. However, persisting feeding of the disliked food seems to lead to increased intake. A 2007 study by Maier found that repeated exposure (eight times) to an initially disliked vegetable increased average intake from 39g ± 29 to 174g ± 54 (p<0.001).² This equated to an average increase of 17g per exposure.

Simply offering new foods will not necessarily produce liking; kids must *taste* new foods. Yet most parents draw conclusions about their child's preferences after two or fewer exposures. Factors such as the infant's feeding regime (bottle vs breast), experiences with food and flavour variety, and parents' feeding style, have also been linked to the development of food preferences and food intake in general.

Breastfeeding

According to Maier 2007, breastfed infants tend to more readily accept a new food during weaning, compared to bottle fed infants.³

A meta-analysis of the long-term (>12 months) effects of breastfeeding (defined in a variety of ways eg 'ever', duration) shows it is important for health outcomes, including reduced risk of obesity; blood pressure; cholesterol; type 2 diabetes; and improved IQ performance. However, the evidence is less clear as to whether this depends on exclusive breastfeeding. It seems the improved outcomes related to breastfeeding can be achieved with mixed breastfeeding.⁴

Timing of solids

There is little independent evidence regarding timing of solids and obesity risk. Current guidelines to delay the introduction of solids to six months flow from the recommendation to exclusively breastfeed for six months.

Most studies that report adverse outcomes of early introduction of solids define 'early' as prior to age four months. However, according



to a 2009 European Food Safety Authority report, introduction of solids at four to six months is safe and does not pose a risk of adverse health effects.

Australian guidelines are relatively specific, recommending iron-enriched breakfast cereals first, then vegetables, fruits, meats, poultry and fish added gradually. However, studies evaluating outcomes (short or longer-term) related to the order in which solid foods should be introduced are rare. A survey of new mothers found iron fortified cereal was introduced at four months, fruit and vegetables at five to six months, meat at eight months and dairy at 10 months.⁵ Although meat is known to be a good source of nutrients required early in life, introduction of meat was delayed.

Texture tolerance

Texture is related to achievement of chewing developmental milestones, which impacts on speech development. There is also evidence that texture tolerance may influence food

acceptance and eating behaviour. Many mothers delay introducing lumpy or chopped foods as they are afraid of choking or vomiting. If infants are not introduced to chewable foods at a time when they are first able to chew, they may be less likely to accept new textures later, and their dietary variety may be limited. This may apply to foods such as meat or hard fruits, that require chewing.

Late introduction of lumpy foods has been associated with children being fussy and having definite likes and dislikes⁶ (see Table 1). Infants introduced to lumps after 10 months of age were more likely to be said to be difficult to feed at 15 months, compared with those introduced at nine months or earlier. Delayed introduction of lumpy solids appears to increase the likelihood of feeding behaviours such as refusal to eat the right food; being choosy with food; definite likes and dislikes; and being difficult to get into a feeding routine.

Dietary quality

Two recent studies have shown that starting solids early (<17 weeks) seems to be a strong independent predictor of poor dietary quality at 52 weeks, particularly in terms of high intake of non-core foods and beverages, according to Koh et al.^{5,7}

Self-regulation, parenting style and role modelling

Children possess an innate ability to self-regulate their energy intake. However, the extent to which they exercise this is determined by environmental conditions, such as type and amount of food provided, feeding practices and role modelling.

Feeding strategies that are responsive to children's hunger and satiety cues, and which encourage children's attention to their internal signals of hunger and fullness are needed to support self-regulation.

Coercive or emotional feeding practices that override infant cues (eg insisting a child eat, use of explicit encouragement or rewards) are common. Essentially these strategies fail to teach young children to eat when they are hungry and stop eating when they are full.⁸

A balanced approach involving clear expectations of children's eating behaviour and being responsive to their needs promotes appropriate nutrition and growth.

Children learn about food through the direct experience of eating and by observing the eating behaviour of others. While research on the role of modelling by parents during early childhood feeding is lacking, there is evidence suggesting parent-child interactions influence children's preferences, intake patterns, diet quality, growth and weight status.

Children's preferences and intake patterns are largely a reflection of the foods that become familiar to them. Availability of food in the home is an important predictor of intake for children reporting food preferences.



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Table 1. Proportion of children being introduced to lumpy solids at each age who had feeding difficulties at 6 and 15 months of age

Age of introduction	Any feeding difficulties at 6 months (34.2%)	Any feeding difficulties at 15 months (40.0%)
<6 months of age (10.9%)	29.9	29.1
6-9 months (71.7%)	34.3	38.6
10+ months (17.4%)	38.8	52.3

Insights from mums

on starting solids

To understand how to help mums adopt healthy early childhood feeding practices, MLA commissioned research* on today's mums' behaviours and priorities.

On nutrition

Mums care deeply about their baby's nutritional needs. They want to provide their children with balanced meals, high in nutrients and low in 'nasties': salt, E numbers etc.

When introducing solids, they prefer to make food from scratch. They prefer fresh ingredients over processed foods, supplements and fortified foods. Most are into batch cooking and freezing portions to last one or two weeks.

They would also like their kids to enjoy a diverse range of foods and flavours when they are older. They hope that if their kids start eating well early, it will continue as they get older.



Mums want advice on how to cook red meat for babies

Information seekers

Mums are hungry for information and seek out a range of sources before deciding what they trust. While mothers' groups are key influencers, books such as Robin Barker's *Baby Love* are popular, along with Annabel Karmel's books on meal ideas.

Magazines provide recipe inspiration and parenting tips. Popular magazines include: *That's Life*, *Woman's Day*, *Practical Parenting*, *Sydney's Child*, *Mother and Baby*, *New Idea*, *Good Taste*, and *Family Circle*.

The internet is a key source of information, with Google the main starting point. Forums, such as Kidspot, are popular.

Mums generally seek information when they perceive their child is ready to start solids (around four to six months), rather than in advance. Mums prefer advice that acknowledges that each child is different.

In the kitchen

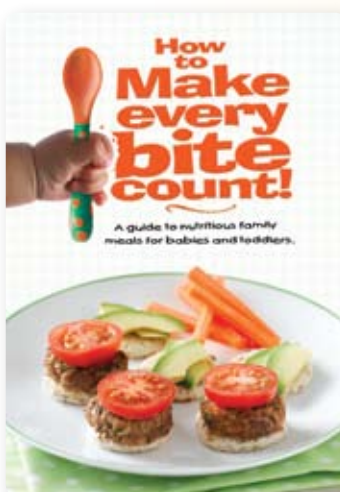
Mums want simple, practical meal ideas that are quick to prepare.

Today, mums are more likely to prepare only one meal for everyone, including kids. Many are keen to ensure their kids do not become fussy eaters, because this will mean having to cook multiple meals for the family. They are therefore keen to receive advice on how to adapt family meals to suit the whole family.

When it comes to red meat, mums are delaying introduction because they don't know how to cook red meat for their babies. The research identified a need for practical advice on cooking meat for babies and toddlers.

* Research was conducted by The Leading Edge and findings were presented at the symposium by a senior consultant at the company, Natalie Hunter.

NEW BROCHURE ON STARTING SOLIDS



Our new brochure provides advice on feeding babies and toddlers. It provides recipes for family meals which can be adapted to feed babies and toddlers. For example, as illustrated below, the Beef and vegetable skewers is adapted to feed the family; the baby; and toddler according to their developmental stage.



Family meal



Starting solids



Lumpy stage



Finger food



Toddler meal

To order copies, call:
1800 550 018

Combating micronutrient deficiencies during early childhood in low income countries

Professor Rosalind Gibson is a world expert on micronutrient nutrition in low income populations. She is based at the University of Otago and has developed sustainable, diet-based strategies to combat micronutrient deficiencies in developing countries.

Common deficiencies

Micronutrient deficiencies are common in low income countries; especially vulnerable are infants, children, and pregnant and lactating women. In general, deficiencies of iron, zinc, iodine and vitamin A are most common. However, specific regions have their own problems, for example calcium deficiency in Nigeria, vitamin D deficiency in Mongolia, and selenium deficiency in China.

In New Zealand, iron intakes from complementary foods in infants (9–11 months) are often below WHO estimated needs, and in the South Island, almost 30% of children aged 6–24 months have been reported to have suboptimal iron status.¹ In Australia, vulnerable groups include indigenous people in remote communities. Deficiency of micronutrients, notably vitamins B12, B2, D, A, iron and zinc, in combination with poor growth and cognitive development, have also been reported in infants fed macronutrient diets.

Prevalence of micronutrient deficiencies by region

Region	Vitamin A (%) ^a	Insufficient iodine intake (%) ^b	Anemia (%) ^c	Zinc (%) ^d
Africa	49	43	46	71
SE Asia	69	48	57	68
Americas	20	25	19	46
Europe	N/A	32	10	8

^a Proportion with clinical eye signs and/or serum retinol <0.70 µmol/L in children <5

^b Proportion with urinary iodine <100 µg/L

^c Proportion with low haemoglobin

^d Risk of inadequate intake; food balance sheet data adjusted for phytate: Zn ration

From Alben et al (2006) & IZINCG (2004)

Causes and effects

Micronutrient deficiencies stem from poverty and its many sequelae, such as food insecurity in the home, poor care and sanitation, and inadequate health services. These lead to disease and poor dietary intake, which together result in micronutrient malnutrition.

The many causes of poor dietary intake during childhood can be divided into those due to inadequate quantity or quality of food. Deficits in quantity arise from factors such as limited gastric capacity, poor child feeding practices and anorexia. Deficits in quality are associated with semi-liquid cereal-based porridges with a low dry matter content, and diets low in animal-source foods, which as a result, have a low micronutrient density and poor bioavailability.

Micronutrient deficiencies can have serious adverse consequences. Iron deficiency may lead to anaemia, lower work capacity, and impaired cognition.

Strategies for combating micronutrient deficiencies

1. Supplementation – There are currently no national multi-micronutrient supplementation programs for alleviating co-existing multi-micronutrient deficiencies in low income countries. For prevention, vitamin A is given to children under five; and for treatment, iron is given for anaemia; iodine for goiter; vitamin D for rickets, and zinc for diarrhoea.

2. Food fortification – This may involve targeted fortification, for example use of lipid-based micronutrient fortified spreads; micronutrient powders or crushable tablets in the household; or national fortification programs. For example, fortification of maize or wheat flour with a variety of micronutrients, such as iron and zinc; and fortified condiments, for example salt with iodine. However, fortification levels for national programs are not designed to meet infants' and young children's high micronutrient needs.

3. Dietary diversification and modification (DDM) – The focus of this strategy is to facilitate changes in food production and food selection patterns, plus changes in traditional household methods for preparing and processing indigenous foods. The goal is to enhance availability and use of foods, high in bioavailable micronutrients. Examples include: increasing the dry matter content of porridges; improving micronutrient bioavailability by adding absorption enhancers and reducing inhibitors; and increasing intake of animal-source foods. These strategies should be introduced after six months of age, along with encouraging breastfeeding to at least two years.

4. Biofortification, for the future – For example using fertilisers to increase grain micronutrient content, and breeding plants high in micronutrients, such as cereals high in iron and zinc, and sweet potatoes with increased β-carotene.

Impact of strategies

Sometimes these strategies have had mixed results due to the many cultural, social and political barriers which have impeded their success, and the complex, multifactorial causes of the problems.

Regional conditions may also affect outcomes. For example, two identical studies of iron and folic acid fortification +/- zinc, one in a non-malarial area, and one in an area where malaria was prevalent, found opposite results. The former study suggested the supplement may protect against disease, whereas the latter found it was associated with an increased risk of death. Programs can also have unintended consequences. In India's south Delhi, introduction of fortified milk-based complementary food increased morbidity in infants, perhaps due to displacement of breast milk, or because the food was prepared with contaminated water.

Benefits of food-based strategies

DDM strategies can be designed to be sustainable and safe, requiring minimal inputs once behaviour change is achieved. Because they are community-based, they have the added advantage of empowering

deficiencies

populations

people to help themselves. Selection of culturally acceptable foods improves compliance. However, to achieve maximum impact, DDM strategies must also be integrated with public health strategies, such as antenatal care and immunisation services.

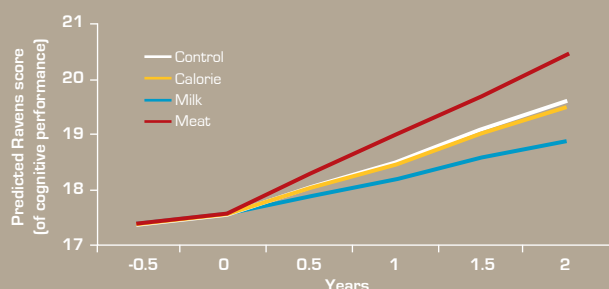
Use of animal-source foods

DDM strategies using animal-source foods have been most successful, possibly because these foods tend to be rich sources of several bioavailable micronutrients such as iron, zinc, vitamin A (liver), B12, niacin, calcium and riboflavin (dairy), depending on the type of animal source food consumed. Consequently, animal-source foods help to prevent concurrent micronutrient deficiencies such as iron and zinc, which tend to co-exist. In addition, meat has the capacity to enhance non-haem iron and zinc absorption.

Strategies designed to increase intake of animal-source foods have reported benefits in terms of micronutrient status as well as health outcomes. Improvements in growth (weight, mid-upper arm/head circumference); cognitive performance; a positive association with psychomotor development; and a trend towards a higher behaviour index have been reported.^{2,3}

The relative effects of different animal source foods, compared to the simple provision of additional calories, were shown in a study in Kenyan schoolchildren, given one of three types of snacks (meat, milk, or calories) for school lunch for two years. Vitamin B12 status improved in both the meat and milk groups, whilst linear growth in stunted children improved in the milk group only.⁴ Improvements in cognitive performance, physical activity, initiative and leadership scores and school test scores were reported in the meat snack group only (see Figure 1).^{4,5}

Fig 1. Cognitive test scores among Kenyan schoolchildren receiving either of three intervention snacks versus control⁵



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PANEL DISCUSSION

HOW TO HELP MUMS ESTABLISH HEALTHY EATING HABITS IN CHILDREN

Discussion included perspectives from panel members and questions from delegates. Discussion points are summarised below with concluding statements from Claire Hewat, DAA's CEO.

Many mums need education and reassurance around their concerns about choking, swallowing and the gag reflex. To help them address these concerns, they need advice on: understanding cues from babies, so they can practice responsive feeding; how children should sit while they eat; and preparing food for the appropriate age of their child. This is important, as feeding and development are inextricably linked in many ways, for example harder to chew foods help with development of mouth muscles and also influence feeding practices at a later stage.

CH: "We may need to collaborate with colleagues, such as early childhood nurses and speech pathologists, who have expertise on subjects such as swallowing and choking."

Achieving effective behaviour change is critical. Providing mums with information at the appropriate time is part of the solution. They generally access services when there is a problem, and this is often too late, as behaviours are entrenched. It's therefore important to understand the channels through which mums access information, such as the internet and mother's groups.

CH: "We need strategies to reach mums when they are receptive, and clearly mothers' groups are key. If we can intervene at the right time, it's one of those pressure points where we can really achieve something, not just for the child but for the whole family."

Preventing obesity and iron deficiency are priorities.

CH: "In Australia we still have both scenarios: children living in an obesogenic environment and those who live in low income conditions. At our peril, we forget that nutrient deficiencies still occur here. If you are working in remote or rural communities, or with people from those areas, keep that in mind, even though this is considered a first world country."

There is a need for more research into protective eating behaviours.

CH: "There is a paucity of evidence, and it's important to note that RCTs are not necessarily the best sort of study for dietary intervention."



From left to right: Rosemary McCowage, Tresillian child health nurse; Professor Lynne Daniels, QUT; Professor Rosalind Gibson, University of Otago; Kate Di Prima, APD and author of *More Peas Please*; Natlie Hunter, Leading Edge Consultant.