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NEWS AND VIEWS

The development of childhood dietary preferences and their implications for later adult health

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Summary

The food fed to infants and young children not only determines their health in childhood but also predicts the foods that they eat in later life. Because adult dietary preferences are partially formed in childhood, the childhood diet inevitably contributes to the long-term health of the individual. We are all aware of preferences that have endured since childhood, and that our dietary habits only change if we have reason to adapt them, perhaps for a healthier lifestyle. Adopting a healthy diet in adulthood is likely to be considerably easier if we have developed healthy food preferences during our childhood.

Current information shows that toddlers are fed diets high in fat, sugar and salt and that mothers are confused about what toddlers should be eating.

A healthy diet for toddlers combines foods from all the five food groups. This combination involves mixing high-calorie and low-calorie foods. Healthy food options should be introduced from weaning, and offered repeatedly through the infant and toddler years. Furthermore, the whole family should model a healthy eating lifestyle in order to foster the acceptance of foods that constitute a well-balanced diet.

Keywords: childhood diet, dietary preferences, food behaviour, toddler nutrition

The development of food preferences

From an evolutionary standpoint, food preferences must be established and learned in infancy and childhood. These preferences are not hard-wired; they develop as the child learns about foods that are safe and culturally appropriate. This learning process begins as soon as the infant is fed solid foods, and the preferences are carried on into later life, with some opportunity for the addition of new foods in later childhood and adulthood, as the seasons or environment change food availability.

The development of food preference is not, however, the same for every child. There are genetic differences in the willingness to accept new foods, especially those of extreme taste, such as bitter (Turnbull & Matisoo-Smith 2002), or texture, such as fish (Breen *et al*. 2006; Cooke *et al*. 2007). Children can be more or less neophobic (reluctant to try new foods) according to their temperament (Pliner & Loewen 1997). This neophobic phase starts at the beginning of the toddler years, and is less

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extreme if the child has role models (such as siblings and/or parents) who eat a wider range of foods.

Learned food preferences are therefore determined by two factors. The first is exposure to a food; and more exposures are needed as the child gets older (Birch *et al.* 1987). The second is modelling the eating behaviour and preferences that the child sees within his or her social groups (Harper & Sanders 1975; Birch 1980).

Influence of food exposure

The exposure effect starts very early in life. Foods eaten by a breastfeeding mother may influence the specific acceptance of, or reaction to, foods by the infant (Menella *et al.* 2005). Infants whose mothers ate fruit during breastfeeding showed a greater acceptance of peaches (Forestell & Mennella 2007), although it is not clear whether these effects are the result of the transmission of flavours via the breastmilk, or that mothers who breastfeed are more likely to give fruit to their infant during the weaning period. This priming effect may go in either direction. In a study carried out on rats, those whose mothers were fed a 'junk' food diet during pregnancy and lactation showed a preference for a high sugar, fat and salt diet when they were weaned (Boyol *et al.* 2007). However, we need to interpret these data with caution; there is no evidence to date that this effect may occur in humans.

Breastfeeding does, however, confer a generalised advantage during the weaning period when solid foods are introduced, as breastfed infants tend to show a greater liking for new foods (Maier *et al.* 2008). The introduction of solid foods can also produce a similar generalised effect as well as specific effects.

Tastes that have been given to the infant between four and six months are more likely to be accepted (Harris 1993), and even foods that the infant seems to initially dislike can be accepted with continued exposure (Maier *et al.* 2007). Both of these effects are results of exposure to specific tastes or foods. In addition to this, the more frequently foods are offered during this 'window of opportunity' (*i.e.* the four–six month period), the more likely the infant is to try a new food (Maier *et al.* 2008). Infants were more likely to accept a new vegetable offered to them in the weaning period if, in the previous nine days, they had been fed a regime of three other vegetables which were changed daily. The comparison groups were those who were offered one vegetable for all of the nine days, and those who were given three different vegetables that were changed every third day (Maier *et al.* 2008). Therefore the more variety infants are given, the more they are willing to try new tastes.

Food preferences are, of course, not just determined by taste, but also by texture. Once again, acceptance is dependent on exposure (Mason *et al.* 2005). In the one study in this area, the best predictor of texture acceptance at 12 months, (pieces of carrot) was prior experience – the frequency with which chopped food was offered and consumed during meal times (Blossfield *et al.* 2007).

There is then evidence that food preferences are established early in life. But longer-term generalised effects are also apparent. In a study using the Avon Longitudinal Study of Parents and Children (ALSPAC) database, Northstone *et al.* (2001) found that the introduction of solid lumpy foods after the age of 10 months, when compared with introduction before six months or between six and nine months, led to more feeding difficulties and food refusal at 15 months. A follow-up study (Coulthard *et al.* 2009) found that the age at which lumpy solids were introduced predicted the acceptance of a range of fruit and vegetables at 7 years. The earlier the introduction, the greater the range of foods accepted. Therefore early introduction of solids predicts later food acceptance.

Modelling and the family diet

In infancy and at weaning, exposure seems to facilitate acceptance of new foods. But in the toddler years, when the neophobic response develops, it is the modelling effect that becomes more important. Toddlers learn to like both what they are given (Cooke *et al.* 2003) and those foods that they see the family eats. They are more likely to accept new foods if they see an adult eating it at the same time (Addessi *et al.* 2005).

Clearly, if toddlers are modelling their eating behaviour on those that they see around them, the importance of the family diet is paramount. Toddlers will not develop healthy eating habits in isolation. They need to see their parents and siblings eating healthily and making healthy food choices. But for this to happen, parents need to understand what these healthy choices are.

Unfortunately, there currently appears to be considerable confusion over what constitutes a healthy diet for infants and toddlers. This was highlighted in a recent poll initiated by the Infant and Toddler Forum (Infant and Toddler Forum 2009) and conducted by *OnePoll*. The online survey questioned 1000 mothers from different socio-economic classes and regions across the UK (England, Scotland and Wales), with children aged between 9 months and 3 years. The mothers were asked 15 questions about their feeding habits and attitudes as well as their nutritional knowledge.

The results suggested that a lack of information about what toddlers should eat played a significant role in the choice of inappropriate foods. Some 42% of mothers said they had not received clear and consistent advice on feeding under threes and 26% said they wanted more help from health professionals. Twice as many mothers found their nutritional advice in the media, books and Internet (34%) than via their health visitor (15%).

Of particular concern was the fact that 95% of mothers said they were following the government guidance to feed their toddler like the rest of the family – but for 44% of those questioned, this meant using pre-prepared convenience foods. Twenty-nine percent of under threes were fed takeaways at least once a week and 19% of toddlers were fed takeaways or adult-ready meals for most meals.

Clearly, the advice to feed toddlers the same foods as the rest of the family should not be delivered without an understanding and clear assessment of what the rest of the family is eating. At present, it seems likely that the early exposure of children to these foods, which are often high in salt and fat and so inappropriate for toddlers, is inducing long-lasting preferences for these tastes. It may also decrease opportunities for exposure to a varied range of fruits and vegetables which should form part of a healthy diet.

One quarter of mothers reported making alternative meals for their child when they refused to eat. If the mothers were to allow some repeated exposure to disliked foods, which are often the healthier foods such as green vegetables, this would eventually increase acceptance.

Around 31% of the mothers questioned admitted to feeling tense, anxious and stressed during meal times. This can negatively affect the child's eating behaviour. It is therefore important to recognise that meal times are not just about eating, but also about having good quality family time together. Modelling good eating in social groups, as well as praising toddlers when they eat well, will encourage them to enjoy their meals.

Taste preferences, dietary deficiency and obesity

The National Diet and Nutrition Survey of 1995 (Gregory *et al*. 1995) showed that 85% of children between 1.5 and 4.5 years of age consume significant amounts of biscuits, savoury snacks, chocolates and soft drinks. This may be a significant factor in the rising rates of obesity among toddlers. The incidence of obesity in 3–4-year-olds increased from 5.4% in 1989 to 9.2% in 1998 (Bundred *et al*. 2001).

Toddler diets may also be deficient in essential vitamins and minerals. It has been shown that 82% of children consume a diet providing less than the recommended level of iron, with 15% at serious risk of becoming deficient (Gregory *et al*. 1995). In addition, 95% of children consume less vitamin D than the recommended amounts and about 50% have a low vitamin A intake (Gregory *et al*. 1995). The Department of Health recommends giving all children vitamin drops (vitamins A, C and D) from the age of 1 to 5 years old. It is particularly important to give vitamin drops to fussy eaters, children living in northern areas of the UK and those of Asian, African and Middle Eastern origin (Department of Health 2007).

Dietary guidance for parents of toddlers

Good eating habits and a varied and nutritious diet are essential for toddlers' health, growth and development.

A healthy diet for toddlers should be based on the five food groups (Food Standards Agency 2009):

- bread, rice, potatoes, pasta and other starchy foods;
- fruit and vegetables;
- milk and dairy foods;
- meat, fish, eggs, beans and other non-dairy sources of protein; and
- foods and drinks high in fat and/or sugar.

A balanced combination of foods from these groups should be offered and judged over the week rather than day to day, as the amounts toddlers eat from each food group will vary from toddler to toddler, day to day and meal to meal. Portion sizes tend to get larger as children grow older and bigger. Toddlers should eat according to their appetite rather than to set serving sizes. They should not be deprived of sugary foods, but it is important to remember that too much can increase the risk of obesity and dental caries (Department of Health 2007).

Toddlers benefit from a daily routine of meals and snacks such as three meals and two to three nutritious snacks per day – but not all toddlers will need to snack this often. Ideally, a food from the bread, rice, pasta and cereals group should be included in every meal or snack. It should also be remembered that repeated exposures to some of the more difficult tastes and textures, which are often found in fruits and vegetables, should be maintained in order to develop an acceptance of these foods.

Foods that should be avoided by toddlers include salty foods, drinks with sweeteners, raw eggs, raw shellfish, some large fish and whole nuts.

It is also important for toddlers to drink six–eight drinks per day to ensure adequate hydration. Milk and

water are the best drinks to give between meals and snacks. All fruit juices and squash should be diluted (Department of Health 2007).

Conclusions

Foods given to infants and toddlers can affect their food choices and health later in life. Current information shows that toddlers are fed diets high in fat, sugar and salt and that mothers are confused about what toddlers should be eating.

A healthy diet for toddlers combines foods from all the five food groups. This combination involves mixing high-calorie and low-calorie foods. More specific dietary information will be required when certain foods are avoided because of cultural or religious reasons, lifestyle choices or food allergies and intolerances.

Most importantly, it should be remembered that, in order for a toddler to eat a healthy diet, 'healthy' food options should be introduced at the age of weaning, and offered repeatedly through the infant and toddler years. In addition to this, the whole family should model a healthy eating lifestyle, that is, eating good foods together at mealtimes, in order to foster the acceptance of foods that constitute a well-balanced diet.

Conflict of interest

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