Family food environments as determinants of preschool-aged children’s eating behaviours: implications for obesity prevention policy.
A review

Karen Campbell and David Crawford

Abstract Children’s eating behaviours are fundamental to their health. Dietary surveys indicate that children’s food consumption is likely to promote a range of diet-related diseases, including overweight and obesity, which are associated with a range of psychosocial and physical disorders. With the prevalence of overweight and obesity rapidly increasing, opportunities for informed prevention have become a focus of strategy. Diet is recognised as important in the genesis of obesity. We present data that demonstrate that eating behaviours are likely to be established early in life and may be maintained into adulthood. We review literature that shows that children’s eating behaviours are influenced by the family food environment. These findings suggest that the family environment should be considered in developing obesity prevention strategy for children, yet the current strategy focuses primarily on the school environment. Those factors in the family environment that appear to be important include: parental food preferences and beliefs, children’s food exposure; role modelling; media exposure; and child-parent interactions around food. However, the existing data are based on small scale and unrepresentative US samples. At a population level, we have few insights regarding family food environments and consequently little information about how such environments influence children’s eating behaviours and thus their risk for obesity. We suggest research that may promote a better understanding of the role of family food environments as determinants of children’s eating behaviour, and consider the implications for obesity prevention in Australia. (Aust J Nutr Diet 2001;58:19–25)

Key words: eating behaviours, children's eating, family food environments, obesity prevention, paediatric obesity.

Introduction

Obesity has reached epidemic proportions throughout the world (1). In Australia, the prevalence of obesity [body mass index (BMI) > 30kg/m²] and overweight (BMI 25–30 kg/m²) is rapidly increasing (2), with most recent data showing more than half of all adults are obese or overweight (3). However, this problem is not restricted to adults. In Australia, recent estimates from three independent surveys (4) suggest that 16.1 to 16.9% of boys are overweight and 5.1 to 6.9% are obese. Figures for Australian girls are 17.4 to 20.4%, and 5.7 to 7.0% respectively. In these analyses Booth et al. used BMI as the index of adiposity, and recently published BMI cut-off values (5) were used to categorise obesity and overweight (4).

Halting the rising prevalence of overweight and obesity in children is an important public health priority (1,6). Overweight and obesity in childhood have a significant impact on psychosocial health, with overweight children often becoming targets of early and systematic discrimination (7). There are also physical health consequences (7,8). Guo and Chumlea report that the risk of obese children (defined as BMI above the 95th percentile for weight) developing adult obesity (BMI > 28) is up to 80% at age 35 years (9). Obesity in childhood has been shown to be an independent risk factor for adult obesity (10) and to have implications, independent of adult obesity, for health in adult life. For example, Must et al. (11), in considering long-term morbidity and mortality of overweight adolescents, found that adolescent overweight predicted a broad range of adverse health effects that were independent of adult weight. In adults, overweight and obesity negatively impact on psychosocial and physical health (12,13).

The aim of this review is to examine the evidence of the role of family food environments as determinants of children’s eating behaviours, (i.e. behaviours related to the consumption of food), and the implications for obesity prevention. We examine the role of diet in the development of obesity and present data regarding contemporary food habits of Australian children. We consider the development of children’s food preferences and how these track into adulthood, and we review data regarding the relationship between food preference and dietary intake. We consider the existing literature regarding the role of the family environment in influencing children’s food preferences and dietary intake. In particular we examine the influence of parental food preferences and beliefs, and contemporary food trends on children’s food exposure; role modelling; media exposure; and child-parent interactions around food. Against this background we examine the strengths and weaknesses of Australian obesity prevention strategy for young children. We suggest directions for future research to inform the development of obesity prevention policy and facilitate the design of better targeted obesity prevention interventions for young children.

The role of diet in the development of obesity

Diet is recognised to be important in the development of obesity. However, there is debate regarding the relative importance of diet versus activity in the genesis of fatness (14,15). This debate has been heightened by the anomalous situation whereby dietary surveys in the US suggest that fat and energy consumption are reducing,

School of Health Sciences, Deakin University, Melbourne, Victoria
K. Campbell, BSc, GradDipDiet, MPH, PhD Student
D. Crawford, BSc, PhD, Nutrition Research Fellow
Correspondence: D. Crawford, School of Health Sciences, Deakin University, 221 Burwood Highway, Burwood, Victoria, 3125. Email:dcraw@deakin.edu.au

Australian Journal of Nutrition and Dietetics (2001) 58:1  19
while obesity prevalence is increasing (16). However, these data have been challenged by recent ecologic data that suggest that energy availability in the US increased by 15% between 1970 and 1994 and is likely to be a major contributor to increases in average body weight (17). Furthermore, our understanding of fat consumption, as reported in dietary surveys, is weak. Issues such as under-reporting of fat intakes (18,19), difficulty quantifying fat contained in food prepared away from home, and, in the Australian context, an inability to meaningfully compare nutrient data from the three dietary surveys conducted this century, must be considered before we conclude that fat intakes are declining.

Contemporary food habits of Australian children

The most recent National Nutrition Survey (20) suggests that in many respects the diet of Australian children does not meet the current dietary guidelines. In analyses we have performed using the National Nutrition Survey confidential unit record files (3), foods that are considered to contain fat were identified, and foods that are considered to not meet the current dietary guidelines. In analyses we note that in many respects the diet of Australian children does not meet the current dietary guidelines. In analyses we have performed using the National Nutrition Survey confidential unit record files (3), foods that are considered to comprise the core food groups (21), such as breads and cereals, milk, meat, fruits and vegetables, were consumed regularly by the majority of five- to eight-year-olds on the day of the National Nutrition Survey. Collectively these essential food items, along with fats and oils added to breads and cooking, provided around 60% of these children’s total energy intakes.

However, there was considerable disparity in the proportion of children eating these foods. For instance, while nearly all children in this age group consumed cereal and cereal products, milk and milk products, and around 80% consumed meat, poultry and products, four out of ten ate no fruit, and around three out of ten ate no vegetables on the day of the survey. Of the 73% of five- to eight-year-olds who reported eating vegetables, the median quantity consumed was 134 g, which falls short of recommendations (150 g) (21). In addition, around one half of this intake came from potato, most of which was fried (45.5%) or mashed with added fat (28.3%). Furthermore, the average number of different vegetables consumed was just 2.5 (including potato) while the average number of different fruits was limited to 1.5. The bulk of the remaining energy consumed by children on the day of the survey was provided by foods that are actively discouraged in dietary policy.

The National Nutrition Survey shows that, on average, around one-third of five- to eight-year-old children’s energy intake was provided by discretionary sources of sugar and fat such as cereal-based products, including cakes, biscuits, buns and pastry; sugar products and dishes; confectionery and snack foods including potato, corn and extruded snacks, soft drinks and juices. Hence it appears that, in the midst of plenty, Australian children are choosing a varied diet. However, the National Nutrition Survey data suggest that ‘special occasion’ foods may be more important in the promotion of the concept of variety than any other group of foods. An analysis of where we achieve variety is likely to be important in light of recent American data that sought to determine whether dietary variety within food groups influences energy intake and body fatness in adults (22). McCrory et al. concluded that in adults, diets which have a high variety of sweets, snacks, condiments, entrees and carbohydrates, coupled with a low variety of vegetables, promote long-term increases in energy intake and body fatness. Given that no studies regarding dietary variety, energy intake and body fatness are available for younger age groups, it remains unclear whether this would be the case for children.

Food preferences

Food preferences appear to be established early in life. However, the progression of these preferences to adulthood is not clear. Our understanding of this area is limited by the small number of longitudinal studies describing dietary patterns. Nonetheless, there is evidence to support the notion that there is some maintenance of dietary patterns as we age. For example, in the US, Kelder et al. report early consolidation and tracking of self-reported food preferences in a cohort of 2376 students as they moved from 6th to 12th grade (23). While progressive attrition limited this sample (approximately 45% of the original sample re-measured in the sixth year), analysis showed little, if any, attrition bias. In a smaller Australian study (n = 106), Boulton et al. (24) tracked serum lipids and dietary intake of energy, fat and calcium in a cohort of infants who were followed to 15 years of age, together with an additional 123 children recruited from 11 years of age. These authors reported significant tracking of fat, energy and calcium from four years of age. The variance accounted for by the child’s intake at an earlier age varied considerably across ages (e.g. 2–4 years, 4–6 years, 6–8 years, 8–11 years, 11–13 years, and 13–15 years), and across nutrients. For example, the variance in energy intake accounted for by energy intake two to three years earlier ranged from 21 to 40%, and the corresponding figures for fat and percentage of energy as fat were 15 to 20% and 3 to 16% respectively. These results do not suggest that nutrient intakes remain the same throughout childhood. However, despite the inherent difficulties of dietary measurement, they do provide evidence that there are important relationships between nutrient intake in early life and in early adolescence.

In environments where access to food is not limited, food preferences are regarded as a useful indicator of eating habits. For example, Birch describes strong correlations (r = 0.6–0.8) between measures of young children’s food preference and food intake in the experimental setting (25,26). More recently, Drewnowski and Hahn (27) measured dietary intake of college-age women (n = 87) with both three-day food records and a 98-item food frequency questionnaire. Food preferences for most of the 98 foods also were assessed. For virtually all item pairs tested in that study, food preferences and reported frequencies of consumption of the same foods were correlated significantly with each other. Both food preferences and food frequencies predicted dietary outcomes. The authors concluded that food preferences were a predictor of dietary intakes and may provide an alternative to the food frequency approach for dietary assessment. Given this relationship, it is reasonable to suggest that the food

* In calculations of variety, fruits and vegetables were classified as ‘different’ based on the first four numbers in the eight number codes as described in the National Nutrition Survey data set. For example, all types of apples shared the 1611 code, while all pears were coded 1612. These fruits were classified as ‘different’ based on this coding.
intake of children documented by the National Nutrition Survey generally reflect the food preferences of Australian children. It is also reasonable, given the emphasis on supporting children to eat a healthful diet, that we seek to understand the genesis of food preferences.

Influences on food preferences

The interplay between innate, genetically determined taste preferences and those preferences that are learnt is complex. While it is acknowledged that the human response to a number of tastes is innate (e.g. sweet, salt, sour and bitter), the significance of this, in the consideration of the development and persistence of food preferences, remains controversial. Birch (28), in her comprehensive review of the development of food preferences, notes that these predispositions are readily altered through a child’s experience with food and eating. Given the malleability of these innate taste preferences, Birch suggests that current data on infants’ predispositions to respond preferentially to basic tastes can make only a limited contribution to our understanding of the development of food preferences.

Therefore a child’s experience with food has the capacity to modify innate preferences and to establish and maintain new preferences. The learning of these preferences appears to be influenced by a broad range of environmental factors, many of which are played out in the home. Birch (28) maintains that underpinning many of these influences is the parents’ potential to determine their child’s eating environment. The literature in this area is largely drawn from small, homogeneous samples. However, it suggests a range of ways in which family food environments may be shaped. These include the foods made available and accessible, the role of parental modelling, the extent of media exposure in the home, and the ways in which parents interact with children in the eating context. The evidence of the association between these factors and children’s eating is discussed below.

Food exposure

Birch (29) argues that the early exposure that children have to fruits and vegetables, and to foods high in energy, sugar, and fat, plays an important role in establishing a hierarchy of food preferences and selection. A number of experimental studies support the notion that young children’s preference for a food increases as exposure to the food increases (30–33). In addition, Hearn et al. (34) present data from two studies which examine relationships between availability and accessibility and consumption of fruits and vegetables. In one study (n = 13 families), third grade children’s consumption of fruits and vegetables, as assessed by seven-day food records, was related positively to home availability and accessibility of these foods. In a second study of 45 US elementary schools, children were found to eat more fruits and vegetables for lunch at schools that offered more of these foods at this time. Hearn et al. concluded that the extent to which fruits and vegetables are made available and accessible to children may shape their liking for and consumption of these foods.

One factor likely to influence food exposure is the young infant’s propensity to reject new foods (neophobia). However, while neophobia is innate, studies highlight that it can be modified by exposure. For example, Sullivan and Birch in a study of 39 preschool children (mean age 55 months) sought to explore the role of experience with a novel food, eaten either sweetened, salted, or plain, on the development of preferences for those three versions of that food (33). Participants received the novel food 15 times over several weeks, and results showed that preference increased for the exposed version of the food only, with no generalised liking found for the other two flavours of the same novel food. Further evidence that neophobia is modified by experience is provided by a study of four- to six-month-old infants (n = 36) and their mothers, which examined the effects of dietary experience and milk feeding regimen on acceptance of an infant’s first vegetables. Sullivan and Birch report that infants significantly increased their acceptance of a novel food after repeated dietary exposure (ten exposures over ten days) to that food (35).

One important consequence of food rejection is that the rejected food may no longer be offered, thus reducing both the exposure to a range of foods, and the opportunity to learn to enjoy and prefer them. A recent Australian study of 375 parents and primary carers of children aged two to four years, found that 53% of those with children classified as fussy eaters, gave up offering a new food if the child had not accepted it after two or three attempts (Kelloggs, Sydney, 2000. Newspoll. Widespread confusion over toddler food rejection—new research. Are parents putting their children at risk?, media release).

Other potential influences on food exposure are parental food preferences, knowledge, values and beliefs. A study of five- to 11-year-old children and their parents (n = 117 pairs) which assessed neophobic responses to ten novel and ten familiar foods, found that children’s level of neophobia was significantly related (r = 0.31) to parental neophobia (36). Furthermore, in a study of mothers and children (n = 92 pairs) which examined parental and other psychosocial influences on children’s fruit and vegetable intake, Gibson et al. (37) found children’s consumption of foods were related to a range of psychosocial and environmental factors. Independent predictors of children’s fruit intake included mother’s nutritional knowledge, mother’s frequency of fruit consumption and mothers’ attitudinal conviction that increasing fruit and vegetable intake by their children could reduce their risk of developing cancer. Children’s vegetable consumption was independently explained by the child’s liking for commonly eaten vegetables and the mother’s belief in the importance of disease prevention when choosing her child’s food. Children’s confectionery consumption was predicted by the mother’s liking for confectionery and the children’s concern for health in determining what to eat.

The significance of parental food preferences in the development of children’s food preferences has been equivocal, with a recent meta-analysis of five studies showing a significant but weak correlation (r = 0.17) in food preferences of parent-child pairs (38). Recommendations of this review included substantial improvements in study design. Skinner et al. have recently conducted a study which included these recommendations, and have examined food preferences of 118 toddlers, and the concordance with preferences of their family members (39). These authors report that the most limiting factor related to food preferences in toddlers was that a food had never been offered to the child. Furthermore, the similarity
between foods never offered to the child and the mother’s dislikes was significant. This study also showed strong concordance (82–83%) of food preferences between the child and other family members, with no one family member being more influential than another. The observation of familial clustering of nutrient intake (40,41) may provide further support for concordance of food preferences within families.

Contemporary food and eating trends in this country also are likely to affect a child’s exposure to food. For example, in a recent analysis of Australian trends in outsourcing of domestic labour (42), it was found that in the decade since 1984, all forms of food preparation outsourcing increased. In considering a dual income family with a child aged three years and a household income of $1000 per week, it was estimated that expenditure on outright replacement of home cooking (both sit-down and takeaway meals) increased by nine per cent. In addition, Bittman reports that expenditure on raw foods as a proportion of grocery purchases declined significantly over that decade, while expenditure on both reduced-preparation and high-convenience foods significantly increased. Bittman notes that the skills and responsibilities for cooking may be the first of many domestic roles to be transferred to the market place.

**Role modelling**

There is some evidence that food preferences in children may be influenced by role models, most particularly parental and peer models. For instance, experimental work which investigated the social influence of peers on preschoolers’ food preference (n = 39, mean age 46 months) found that a child’s observation of other children choosing and eating foods the observing child did not like, increased the observing child’s preference for and intake of the disliked food (43). In addition, there is evidence that the foods that mothers eat (and hence model eating) appear to provide a particularly powerful influence in shaping children’s food preferences (44), with young children being more likely to imitate their mother’s eating behaviours than that of other carers. Evidence of similarities in family eating patterns, as discussed above under the heading of ‘Food exposure’, may provide further evidence for the importance of parental and sibling role modelling of food preferences. However, it remains difficult to disentangle the role of different aspects of the family food environment.

**Media exposure**

Australian children aged five to 12 years watch, on average, almost two-and-a-half hours of television daily (45), and most of this is commercially sponsored. In addition, around half of all Australians now eat their evening meal in front of the television (45). It is recognised that television is an effective medium for the sale of food products and that the vast majority of foods advertised to children are those which are high in fat, salt and/or sugar and low in fibre (46). Furthermore, television viewing appears closely linked to the consumption of those foods advertised on television for children (47–49). In a study of 64 preschool children (age range 3.0 to 5.5 years) separated into four study groups (four by 16), Birch showed that presenting a food as a reward (both sweet and non-sweet) significantly increased the observing child’s preference for and intake of the disliked food (43). In addition, there is evidence that television viewing influences adolescent food choices. Woodward et al., (50) found significant linear relation between hours of television viewed by 12- to 15-year-olds (n = 2082) and frequency of consumption of 18 of 22 commonly consumed foods assessed. Significance was maintained for ten of the 22 foods even after controlling for socio-demographic characteristics and the frequency of parents’ and friends’ consumption of the food.

**Child-parent interactions around food**

Changing social attitudes to childhood may influence the development of children’s food preferences. Coveney (51) notes that children now are expected to have choice, autonomy and independence. He relates this to the ways in which parents juggle the competing demands of providing their children with foods they will enjoy and foods with which they can display autonomy and self-expression, while at the same time providing a nutritious diet for their children. The trend to prepare food children will eat, as opposed to food adults will eat, may well be an extension of this parenting style.

Child-parent interactions around eating also are important in the development of food preferences that promote weight gain. In considering this area, Birch notes that many of the feeding practices commonly employed by parents, such as restricting foods considered to be nutritionally undesirable, or using foods as rewards, inadvertently promotes behaviours counter to their intentions (29). Recent data serve to illustrate such practices in the Australian context. Qualitative interviews conducted by Morton et al. regarding the management of young children’s snacking behaviour (n = 27), highlighted that mothers regularly employed a range of strategies to limit snacking (52). These included active restriction of snack foods via avoidance, and the promotion of snacks as special, either as treats for special occasions or as rewards for desirable behaviour.

Experimental level data provides substantial support regarding the significance of the social-affective context in which foods are presented to children and the consequent implications for the development of their food preferences. For example, in a study of 64 preschool children (age range 3.0 to 5.5 years) separated into four study groups (four by 16), Birch showed that presenting a food as a reward (both sweet and non-sweet) significantly enhanced the preference for that food (53). To a lesser degree, preference also was enhanced significantly when foods were presented during a brief social interaction with a friendly adult. In both contexts the effects on food preference were maintained and reflected in the post-assessment data collected six weeks after the conclusion of the experiment.

Further evidence of the importance of the social-affective context is provided by studies that show restricting access to foods increases children’s preferences for...
and intake of those foods. In one such study, Fisher and Birch examined children’s eating behaviour before, during and after five weeks of restricted access to a snack food (n = 31, mean age 60 months) (54). The authors reported that restricting children’s access to the target food resulted in an increased behavioural response to that food relative to a control food. Therefore, relative to a similar food that was freely available, the restricted food elicited more positive comments about it, more requests for it, and more attempts to obtain it. A related study of three- to six-year-old children (n = 40), examined the effects of restriction on children’s selection of, intake of, and behavioural response to, a palatable snack food by examining their responses before and during a five-minute period of restricted access (54). That study found that restricting access significantly increased children’s subsequent selection and intake of that food within the restricted contest. In a further study of three- to five-year-old children (n = 71), Fisher and Birch examined the association between mothers’ restriction of children’s access to ten palatable snack foods and the child’s intake when given free access to those ten foods (55). These authors report that maternal restriction of children’s access to snack foods was correlated positively with both girls’ perception of restriction (r = 0.58), and their consumption of those foods (r = 0.59), but had no effect on boys.

Parenting style may affect a child’s ability to regulate energy intake, which may in turn be contributory to the development of obesity. Johnson and Birch (56) found in a study of three- to five-year-olds (n = 77), that the best predictor of children’s ability to regulate energy intake was parental control in the feeding situation, with mothers who were more controlling of their children’s food intake having children who showed less ability to self-regulate energy intake (r = −0.67, P < 0.0001). Parental control in this study was also linked to the parent’s dieting and weight history, with mothers who were more controlling of their children’s food intake eating less than those who were more restrained eaters using more control. In addition, a recent study of 197 families that examined the effects of mothers’ feeding practices on their daughters’ eating and overweight, found that a mother’s efforts to control her own weight, as measured by dietary restraint, in combination with her perceptions of her daughter’s risk of overweight, predicted maternal child-feeding practices, which in turn predicted daughters’ eating and relative weights (57).

Summary

In summary, a range of factors within the family environment may be relevant in determining the development of children’s food preferences and eating behaviours that may promote the development of obesity. Empirical evidence suggests that food availability and accessibility, parental role modelling, television viewing and child-parent interactions around food are all likely to be important. However, we need to acknowledge that the available data are drawn largely from white middle-class US children of normal weight, thus severely limiting their generalisability. In the Australian context we have few insights regarding the family food environment in which our children learn their food habits, or how this might differ across social groups.

Implications for obesity prevention policy in Australia

Rates of overweight and obesity in Australia are among the highest in the developed world (1), and it is therefore not surprising that we lead other countries in responding to this epidemic. In 1997 the National Health and Medical Research Council (NHMRC) released a strategic plan that aims to ‘prevent further weight gain in adults and eventually reduce the proportion of the adult population that is overweight or obese; and to ensure the healthy growth of children’ (6). This strategy focuses particularly on structural (macro-environmental) changes within key settings that will promote healthy food choices and increase opportunities for physical activity. The strategy acknowledges that macro-environmental strategies need to be accompanied by complementary activities that focus on shaping knowledge, beliefs, attitudes and behaviour. However, there is little discussion about the need for action in these areas.

In considering the strategies to ‘ensure the healthy growth of children’, there is a strong emphasis on changing access to food and activity in the school environment. While the school environment is an important setting in which obesity prevention strategies can be implemented, it is clearly not the only, nor necessarily the most important, setting and we must remain mindful of its limitations. The emphasis on the school setting follows a traditional model of health promotion which assumes that changes in knowledge, supported by changes to infrastructure will be powerful in changing behaviours. However, in the case of food and eating, an emphasis on schools does not adequately acknowledge that food preferences of school-aged children are likely to be profoundly influenced by the family environment and to be well established already.

This emphasis on schools also fails to acknowledge that demands on curriculum are greater than they have ever been. Indeed it is reported that the proportion of curriculum devoted to physical activity and health studies has decreased over the past decade (58). As such, obesity prevention activities in schools must compete on three levels: against the established culture of the child’s home environment, against the child’s increasingly established food habits, and within an increasingly crowded learning environment. Given this, we must question the emphasis placed on the schools within the NHMRC obesity prevention strategy.

Obesity prevention policy that focuses predominantly on school settings acknowledges that this environment provides well established structures in which to implement macro-environmental change. However, such a focus under values the role of the family environment (micro-environment) in developing and sustaining eating behaviours. The literature, we have reviewed highlights the potential importance of food availability in the home, parental modelling, media exposure, and interactions with children in the eating context. These are not the kind of macro-environmental influences that are the focus of the NHMRC obesity prevention strategy. They are, however, likely to be centrally important in determining how the macro-environmental forces will be played out in the home environment.
Conclusion

Efforts to prevent overweight and obesity in children are constrained by the paucity of information that describes the family food environment in which children’s food preferences evolve and are maintained. The existing literature suggests a number of ways in which children’s family food environments might promote eating behaviours that increase the risk of obesity in susceptible individuals. However, current data are limited in scope and subject diversity and there are almost no Australian data. The data we have reported here are predominantly based on experimental studies and/or are derived from white, middle-class children of normal weight in the US, thus severely limiting their generalisability.

We suggest those factors in the family food environment that are associated with the development of eating behaviours likely to promote weight gain in children need to be examined. These include parental food preferences and beliefs; children’s food exposure; role modelling; media exposure; and child-parent interactions around food. The research agenda we advocate has a strong focus on the characterisation of both family food environments and children’s eating behaviours and thus would consider food habits in the social context. Such research would inform the development of policy, and facilitate the design of better targeted nutrition intervention strategies addressing a range of chronic health conditions, including obesity.

Acknowledgments

Karen Campbell is supported by a National Health and Medical Research Council scholarship. David Crawford is supported by a National Heart Foundation Nutrition Fellowship.

References