Nutrition and the life cycle: nutrition and the school child

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Abstract

This is the third in this series of articles examining nutrition and the life cycle. The first considered current thinking regarding nutrition in pregnancy (Vol 9(17): 1133–8), and the second discussed nourishing the infant, particularly in relation to weaning (Vol 9(21): 2205–16). This article considers nutrition and the older child. The school years are characterized by increasing independence from parents and exposure to values from outside the home. After being neglected for some years, childhood nutrition is again giving cause for concern. Some children are not eating enough, or not the right nutrients at the right time, while others are becoming overweight, with possible severe long-term effects on their health. Many of these problems are not related to poverty, but rather to changes in lifestyle. Some older children, however, are undernourishing themselves in an attempt to obtain a particular body shape. The last two articles in this series will review nutrition in adulthood and in older years.

This is the third article in this series outlining current thinking with respect to nutrition for the healthy individual at different stages of the life cycle, and will review the literature concerning nutrition and the child of school age. This is a time when parents have less control over the behaviour of children, and when other influences, particularly those related to peer pressure and television, become increasingly important. It is also a time when habits of a lifetime are formed, and when patterns of health and ill-health are established.

The importance of good nutrition in childhood has long been recognized. However, there seems to have been a trend recently to assume that, with increasing affluence, children are being provided with all the food they need to maximize their potential. While this is an attractive idea, there are reasons for believing that it is not the case, and this article aims to outline some of the issues.

The swings in concern about childhood nutrition are reflected in the history of school meals. At the turn of the century education authorities were required to provide a midday meal to all school children who wanted one. These meals were expected to provide one-third of the children’s estimated daily nutritional requirements, and were also free to families on lower incomes (Cotterel et al, 1994).

In 1980, the strict rules concerning the quality and nutritional content of school meals were relaxed, and free school milk was also discontinued. The current situation is that local authorities must provide a midday meal on school days for all school children who want it; the meal is free to those whose families receive income support or job seeker’s allowance, and costs £1.05 for other children. There are no formal nutritional standards. This is being reviewed, and it is likely that some sort of statutory minimum requirement will be introduced once again. Some education authorities also provide milk at cost price.

Schools are now being encouraged to improve their pupils’ general nutrition by integrating the provision of school lunch with a school-wide approach to improve pupils’ diets through lessons, school environment, and extracurricular activities (Journal of School Health, 1997). Some schools are even providing breakfast (see below).

As children reach 4 or 5 years of age their rate of growth slows down and remains lower until they reach the adolescent growth spurt. The child’s nutritional requirements reflect this change, and are not as great, if expressed by body weight as in infancy. Thus, a 12-month-old boy requires 0.23 MJ/kg/day (56 kcal/kg/day), while the 10-year-old requires 0.16 MJ/kg/day (38 kcal/kg/day), and the 40-year-old man requires 0.1 MJ/Kg/day (22 kcal/kg/day) (Ministry of Agriculture, Food and Fisheries (MAFF), 1995). The nutritional requirements of children are summarized in Table 1.

IN WHAT WAYS ARE CHILDREN’S DIETS INADEQUATE

First, some children are simply not eating enough, or not at the right times, as discussed below. In particular, many children are
missing breakfast, with serious consequences. There are two potential ways in which missing breakfast could adversely affect children:

- The first is that the metabolism undergoes short-term alteration, which causes difficulties for the child that day. These alterations could include a fall in blood glucose and insulin levels, leading to a low grade stress response, which could, in turn, lead to a fall in cognitive function.

- The second consequence is that skipping breakfast is part of a pattern of undernutrition that causes long-term problems (Pollitt, 1995).

A review by Pollitt (1995) highlights the value of school breakfasts. Poorly nourished children perform better at school on days when they have eaten breakfast. Pollitt discusses several studies showing that children performed better in cognitive tests, particularly those relating to memory and language, if they had been provided with breakfast, and that they were also more emotionally stable.

However, the evidence is rather less clear for children who are well nourished (assessed from their height and weight). In this group of children, most studies, including all the British studies included in the review, still found that children performed better if they had eaten breakfast; however, not all studies were consistent in that the nature and the extent of the improvement varied (Pollitt, 1995).

One methodological problem of withholding breakfast from a well-nourished child is that the child is probably used to having breakfast, and any deterioration in performance could be due to the stress of a change of routine, rather than the change in nutrition. There are also ethical problems with this type of research. However, it seems likely that ensuring children have breakfast will enhance the cognitive performance of all children, and will definitely assist those who are generally poorly nourished.

The precise nature of the breakfast required is not fully discussed by Pollitt, but most of the breakfasts in the ‘laboratory’-type trials were simple, consisting mainly of carbohydrate and usually milk. Professor Pollitt was mainly interested in the school breakfast programme in the USA, and concludes that it is definitely justified in areas with a large number of poor families. Approximately 70% of American schools offering school lunches also offer breakfast (Food Research and Action Centre, 1998). Such schools have found additional benefits in improved attendance and reduced tardiness.

Some attempts have been made to introduce trials of a similar programme in parts of the UK. One primary school in East London, known to the author, offers a breakfast club. The club is self-funding, with parents paying £1.50 per child per week to cover overheads and staffing, and then paying for each food item. For example, cereal and milk costs 32p and a carton of orange juice costs 15p. Another London primary school has used lottery funding to start a scheme but will soon be self-funding (Matuszek, 2000). However, the culture in this country, for the most part, is that it is the responsibility of the parent/carer to deliver the child to school on time, clean, having had breakfast, equipped, and ready to learn.

If poverty is the cause of poor nutrition, one group that may have problems are those families headed by a single woman, as they tend to be poor. Additionally, the mother has conflicting demands on her time (Dowler and Calvert, 1995). One study (Onyango et al, 1994) found that these families were indeed poor but that nutrition was adequate, and in some ways superior to other families, e.g. the children of these families were offered more variety in their diet.

In contrast, Dowler and Calvert (1995) found that nutrition was poor in these families, but that children did not fare as badly as expected, as the parents would sacrifice their own diet in order to provide well for their children. However, as discussed in the previous article (Vol 9(21): 2205–16), the Child Poverty Action Group claims that it is still not possible to feed a family, according to Government guidelines, on income support.

<p>| Table 1. Recommended nutrient intake (RNI) |</p>
<table>
<thead>
<tr>
<th>Age in years (boys)</th>
<th>Age in years (girls)</th>
</tr>
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<tr>
<td>4–6</td>
<td>11–14</td>
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<tr>
<td><strong>Energy</strong> (MJ)</td>
<td>7.16</td>
</tr>
<tr>
<td><strong>Protein</strong> (g)</td>
<td>19.7</td>
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<tr>
<td><strong>Iron</strong> (g)</td>
<td>6.1</td>
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Source: Ministry of Agriculture, Food and Fisheries (1995)
Severe dieting is never to be recommended, and any form of energy restriction is inappropriate in young children... For some children of school age, mild energy restriction may be needed, but should be undertaken very slowly, and under careful supervision. Such children should be offered a diet that is similar to their present diet, but slightly modified to reduce the amount of energy available.

OVERWEIGHT CHILDREN AND ADOLESCENTS

Not all families are poor, so can we assume that those who are not are offering their children an adequate diet? Probably not, since many health problems in children may be actually related to affluence. Of particular concern is overnutrition, particularly with respect to energy intake. Indeed, it is possible that childhood nutrition in 1950 was superior to that of today (Meikle, 1999), as rationing caused a reduction in sugary foods, and some fatty foods, while at the same time the government ensured that children received all essential nutrients.

Affluence may be a cause of the increased problem of obesity in childhood. The exact magnitude of the increase in childhood obesity has not been reliably calculated for the UK, mainly because there is not yet an agreed definition of obesity in children (Bellizzi and Dietz, 1999). However, Chinn and Rona (1994) estimate that children are becoming bigger. That is to say, they are likely to have a greater triceps skin-fold thickness and also a greater weight for height ratio.

The increase (which has been greatest since 1986) is substantial, e.g. the average English girl weight increased by 0.5 kg and for Scottish girls the average increase was 1.5 kg (Chinn and Rona, 1994). Some, but not all, of this weight gain is related to an increase in height. The noted increase in height, however, is small, and other researchers (e.g. Chinn et al, 1989) have found no such increase recently. Chinn et al (1989) also show an increase in the range of sizes. In the USA, it is estimated that 22–30% of children are obese (Troiano et al, 1995).

Why is this happening? One’s tendency to develop obesity is influenced by genetic inheritance, but this cannot explain the increase in size and, presumably, obesity. An interesting finding of Chinn and Rona (1994) was that parents were also apparently getting bigger, and that the size of the child was related to the size of the adult; the authors concluded that the reason must lie in family dynamics and lifestyle.

One’s weight is a function of energy intake and energy use; thus, if children are getting bigger they must be increasing their energy intake, or burning less energy in activity or, most likely, both. There are three possible interventions to combat this course of events, and most studies use one or a combination of two or three of these: (1) dietary intervention (2) exercise programmes and (3) behavioural modification.

Dietary intervention

Most obesity prevention treatment programmes include at least some dietary strategies. The aim is to reduce the energy value in the diet. Protein yields 17 KJ/g of energy, and carbohydrate yields 16 KJ/g of energy, while fat provides 37 KJ/g (Ministry of Agriculture, Food and Fisheries, 1995). Thus, for weight of food, fat yields over twice as much energy as protein or carbohydrate.

Most strategies encourage individuals to obtain their energy from carbohydrate, rather than fat. Humans appear to achieve satiation more easily with carbohydrate than fat, and the volume of food that is necessary to meet energy requirements is greater if most of the energy comes from carbohydrate. Most strategies recommend up to 40% of energy being derived from fat, and the rest from carbohydrate; protein should not normally be used for energy.

Ideally, the carbohydrates should be unrefined. In the Western diet, these are provided by potatoes, bread, pasta and rice. Avoiding refined carbohydrates, such as sweets and cakes, means that the child experiences a slow, steady rise in blood glucose, rather than a sudden increase, which may reduce the chances of developing non-insulin dependent diabetes.

Refined carbohydrates should be eaten after a meal, to avoid this steep rise in blood sugar. Restricting sweets to after meals also reduces the total daily number of ‘sugar attacks’, i.e. the occasions when the environment in the mouth is particularly suitable for decay to develop, and therefore is better for dental health. Any diet programme will need to include regular sessions to support the child, as almost all studies (e.g. Johnson et al, 1997) have found that information alone leads to very little improvement.

Severe dieting is never to be recommended, and any form of energy restriction is inappropriate in young children (see Vol 9(21): 2205–16). For some children of school age, mild energy restriction may be needed, but should be undertaken very slowly, and under careful supervision. Such children should be offered a diet that is similar to their present diet, but slightly modified to reduce the amount of energy available. The

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energy from the diet should be a little less than their estimated energy expenditure (Mellin et al, 1987).

**Exercise programmes**

There is a perception that children, particularly older children, are less physically active than they used to be. This could be due to the rise of sedentary activities, such as television and computer games, and also because parents are reluctant to allow their children to play outside due to the perceived dangers from traffic, and people who would deliberately harm them. It is likely that this decrease in physical activity is important in causing the increase in body size of children (Bellizzi and Dietz, 1999).

Attending exercise sessions has limited sustained improvement in weight control (DeWolfe and Jack, 1984), but teaching children to avoid sedentary activities is more successful (Mellin et al, 1987). This is probably because short bursts of physical activity have some effect on energy use during and shortly after the activity, but a more active lifestyle generally increases metabolism for all the waking hours.

**Behavioural modification**

An example of behavioural modification with respect to weight control in children can be seen in the work of Epstein et al (1994a). Behavioural modification clearly overlaps with the intervention above (exercise programmes), but is rather more complex as it involves attempting to alter children’s relationship with food. Thus, children are taught to identify and avoid situations when they eat inappropriately, e.g. many children snack while watching television programmes. They may also need to reconsider how they (or their parents) reward themselves; thus, children who are used to receiving sweets for doing well at school may need to consider buying comics or make-up instead.

Whatever strategy is selected, it will almost certainly not succeed unless parents are involved. There are three types of parental involvement: (1) simply inviting the parents to attend sessions with the child (2) encouraging the parent to make appropriate modifications in their own diet (Epstein et al 1994b), activity or behaviour, and (3) involving the whole family in therapy sessions (Flodmark et al, 1993).

Obesity in children is only weakly linked to health problems; however, it is strongly linked to several health problems in adulthood. Overweight children tend to grow into overweight adults; ‘puppy fat’ does not exist after the age of 5 or 6 years. Children tend to retain the same percentile ranking for body mass index — BMI = weight (kg)/height (m)² — as they grow up (Bellizzi and Deitz, 1999).

The adult who was overweight as a child is more likely to experience other health problems, even when adult weight is taken into account. Indeed, obesity as a child is more closely correlated to adult health problems than obesity in adulthood (Cammell et al, 1999). These problems include coronary artery disease, hyperlipidaemia, hypertension, and reduced glucose tolerance.

**DIET AND CARDIOVASCULAR DISEASE**

There is a well known link between plasma lipid levels and the risk of developing cardiovascular pathologies such as cerebrovascular accident and coronary artery disease (McGill et al, 1996). The risk of developing these diseases is greater in an individual with elevated low-density lipoprotein (LDL) and decreased high-density lipoprotein (HDL). As discussed in the previous article (Vol 9(21): 2205–16), breast milk is very rich in all lipoproteins, and this seems to actually protect the individual from later cardiovascular disease (McGill et al, 1996).

However, what about the diet of children? It appears that atherosclerotic lesions start very early in life. In children, lesions are seen as fatty streaks in the arteries of persons as young as 3 years of age (Berenson et al, 1992). It is not certain that these fatty streaks are of clinical significance, as they do not occlude the vessel and are reversible. However, it is possible that they could develop into raised, fibrotic lesions.

Work from the Bogalusa heart study (Berenson et al, 1992) indicates that these fatty streaks, particularly when they are located in the coronary arteries, are indeed related to high serum triglyceride and very LDL cholesterol, and also to blood pressure. Lauer et al (1988) carried out a major longitudinal study of the relationship between cholesterol in childhood (after 5 years of age) and adulthood. They found a considerable degree of tracking, i.e. those children with a high...
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Plasma cholesterol tended to maintain high cholesterol levels into adulthood.

The adult levels of cholesterol were unlikely to be above the 90th percentile* if childhood levels were below the 50th percentile**, and as childhood cholesterol levels rise above the 50th percentile, the adult cholesterol levels also rise. However, this does not, in itself, indicate that diet in youth and dietary habits are the cause of high or low cholesterol levels, and it is known that there is some genetic predisposition (Berenson et al, 1992).

Research designed to establish whether dietary intervention is effective in reducing serum cholesterol was carried out (Diet Intervention Study in Children [DISC] Writing Group, 1995). Children aged between 8 and 10 years with raised LDL levels were randomized into groups for intervention or normal treatment. The intervention group was given behavioural therapy aimed at achieving a diet where fat provided only 28% of energy, including up to 8% provided by saturated fat, and less than 75 mg/day of cholesterol.

This diet is similar to that recommended for children with a marked family history of coronary artery disease. The intervention consisted of devising a personalized diet based on the child’s present diet, followed by a series of visits to the family GP. The group receiving normal care was advised that the child’s plasma cholesterol was raised, and was provided with written information. No follow-up was organized.

After 3 years the diets of the intervention group were significantly lower in fat, and serum cholesterol levels were also lower. Importantly, the intervention group’s diet was equally adequate in other ways, in that height growth and iron stores were equal in both groups.

**Other Influences on Children**

So why do children persist in taking a poor diet in spite of relative affluence? One possible reason is peer pressure and the effect of advertising. In the USA, children aged between 6 and 11 years watch 23.5 hours of television a week (Koz and Story, 1994). The authors monitored Saturday morning television, and saw 997 adverts for products of which 564 (56.5%) were for food; this amounts to as many as 3 hours of food adverts a week, or one advert every 5 minutes of television watching. Of the adverts for food, 37.5% were for products classified as ‘fats, oils, or sugars’ and 23% were for ‘high-sugar carbohydrates’. Promotion of fast-food outlets, which tend to serve high-fat meals, accounted for 11% of adverts.

All of the adverts were opposed by 10 nutrition-related public-service announcements. The main message from the purveyors of the advertised products was that these foods taste good; 16.9% of the adverts included a promise of a free toy and 7.3% suggested that the food was in some way fashionable. However, 49.1% of adverts implied that the food was healthy, often by stating that the food formed part of a healthy meal.

It is possible, however, that children are not as gullible as it is sometimes assumed. The food industry has fiercely opposed moves in both Europe and America to reduce the amount of advertising aimed at children. The industry must have read research by Galst and White (1976) showing that children’s food choices and purchasing requests were directly related to their exposure to advertised items.

However, this research is rather old. More recent research by child psychologists suggests that children of school age are quite sophisticated, not to say cynical, in their understanding of advertising (Cohen, 1999). Children are able to appreciate the motivation of others and this skill seems to be developing earlier in children, as they are exposed to a wider range of social interaction than they were in the past. For example, 4-year-olds are able to identify who is being targeted by an advert, and most 5- and 6-year olds have learnt that it is possible to say one thing and feel another.

In the UK, there is a voluntary code stating that adverts must not take advantage of children’s natural credulity, or raise unreasonable expectations. Other countries, such as Sweden, have gone further and banned all adverts that target children; however, this may have the effect of forcing television producers to import programmes from overseas, which may be of poorer quality.
However, eventually, many children learn that overeating can lead to obesity, and that being obese is a bad thing. Some children, particularly girls, begin to manipulate their diet in an attempt to achieve a particular body shape. The subject of eating disorders is outside the scope of this article, but nurses need to be aware that many teenage children engage in occasional unwise dietary practices, often trying to achieve a body shape that may be almost impossible. Such practices include binge-purge, severe energy restriction, and fat-free diets (DeWolfe and Jack, 1984).

Boys do not seem to be as vulnerable to attempts to lose weight, but can be just as at risk of this sort of behaviour in the pursuit of athletic excellence. Thus, rugby players may attempt to gain weight, while boxers, gymnasts, and jockeys may try to keep their weight low in order to remain within a certain ‘class’. In order to achieve this, they may be recommended to take certain diets. Nurses need to be aware that this aspect of nutrition is under-researched, particularly as it affects children, and few ‘high-performance’ diets have scientific credibility at present (Sinatra and Sinatra, 1996).

Another way that is popularly believed to result in weight loss is smoking. Whether this is true is very contentious, but many young people believe it works. French et al (1994) followed a group of nearly 2000 teenagers who were mostly white and of upper middle-class families. The children were questioned about their smoking habits and their beliefs concerning diet. They found that girls who were most concerned about their weight gain — in that they very much wanted to be thin, or that they thought about their weight a lot of the time — were much more likely to commence smoking. The same did not hold true for boys, although similar numbers of boys and girls commenced smoking.

CONCLUSION

This article has presented a picture of a wasteful opportunity; most families have the financial resources to nourish their children adequately, yet many fail to do so. Why this is, and what is to be done about it, provides much for the nurse to consider.

KEY POINTS

- Healthy eating for children should be promoted in all aspects of school life.
- Poor nutrition is not related to poverty, but may be associated with other issues such as peer pressure and fashion.
- Programmes for overweight children should include dietary changes, activity and behaviour modification.
- Obesity in childhood can lead to health problems throughout life.

Berenson GS, Wattigney WA, Tracy RE et al (1992) Atherosclerosis of the aorta and coronary arteries and cardiovascular risk factors in persons aged 6 to 30 years and studied at necropsy (the Bogalusa heart study). Am J Cardiol 70: 831–8
Matuszek C (2000) Lottery win cooks up a healthy diet. This article has presented a picture of a wasteful opportunity; most families have the financial resources to nourish their children adequately, yet many fail to do so. Why this is, and what is to be done about it, provides much for the nurse to consider.