Basic nutrition and additional requirements for children who are diagnosed with attention-deficit hyperactivity disorder

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Abstract
Recent research highlights several areas of nutritional concern for children who are 2-8 years of age. These include high intakes of fat and sugar, low intake of fruits and vegetables, limited exposure to a variety of foods, increased fast food consumption and decreased physical activity. These factors contribute to an increased prevalence of overweight and the risk of diabetes and other chronic diseases. Furthermore, the link between artificial food colourings and attention-deficit hyperactivity disorder symptoms has been confirmed.

Introduction
Diet content recommendations are similar for children aged two years and older and for older individuals. The challenge is to provide quality nutrient intake and to avoid excess energy intake.1 Children’s growth rates decrease during the toddler years in accordance with their energy needs. When offered a variety of healthy foods, usually children eat enough to meet their nutritional needs.2 However, unhealthy patterns of food consumption cause alarm, as childhood and adolescent over-nutrition is associated with serious co-morbidities, including type 2 diabetes mellitus, hyperlipidaemia and hypertension. Global increases in childhood lifestyle diseases highlight the need for health strategies that will improve the quality of children’s diets.1,3

In 2000, the National Food Consumption Survey on children aged 1-9 years reported a national overweight prevalence of 6%. Twelve per cent of the overweight prevalence was in the children of educated urban mothers. Then in 2005, the Fortification Baseline reported a 10% national prevalence of overweight and 4% obese children.4

It is increasingly becoming evident that the effects of feeding, food composition, energy intake and dietary behaviour during several critical periods are of paramount importance to health later in life.5 Force-feeding and overfeeding should be avoided. Meals must be low in refined sugar, fat and saturated fat.3,5

Dietary recommendations
It is advisable that children eat a wide variety of foods. There should be an emphasis on fruit, vegetables and whole grains. A low-fat diet [< 30% of total energy (TE)] is encouraged to prevent chronic diseases.1 After the age two, children should drink reduced-fat milk and the amount of other fat in the diet should be decreased gradually.1 Children should eat up to 360 g (the equivalent of two average meals; smaller portions for young children) a week of a variety of fish and shellfish that are low in mercury and high in omega-3 fatty acids.6 The American Heart Association (AHA) continues to recommend diets that are low in saturated and trans-fats. Healthy foods include fruits, vegetables, whole grains, legumes, low-fat dairy products, fish, poultry and lean meats.7

Table I provides a list of the suggested dietary recommendations for two- to three-year-old and four- to eight-year-old males.6,8

Nutrient recommendations
Enough energy should be consumed to support growth and development to reach and maintain suggested body weight.1,2 The recommended dietary allowance (RDA) for protein are 13 g and 19 g per day for one- to three-year olds and four- to eight-year olds, respectively. This translates to 5-20% of TE (acceptable macronutrient distribution range).9

The acceptable macronutrient distribution range for total fat is 30-40% of TE.9 The paediatric guidelines of the AHA have a limit of 40% fat of TE, with an emphasis on a more liberal intake of unsaturated fat, and a focus on ensuring adequate intakes of omega-3 fatty acids.1 Focus is also given to foods that are rich in nutrients and provide increased amounts of dietary fibre.7
The dietary reference intakes (DRIs) for essential fatty acid linoleic acid (n-6) are 7 g and 10 g/day for one- to three-year olds and four- to eight-year olds, respectively. The DRIs for α-linolenic acid (n-3) are 0.7 g and 0.9 g/day, respectively.9 Currently, there are no DRIs for the long-chain polyunsaturated fatty acids (LC-PUFA) eicosahexaenoic acid, docosahexaenoic acid and arachidonic acid.9

The acceptable macronutrient distribution range for carbohydrates is at least 130 g per day (RDA) and 45-65% of energy intake. Added sugar should be limited to no more than 25% TE, and total fibre 19 g for toddlers aged 1-3 years, and 25 g for children aged 4-8 years, per day (RDA) (14 g/4 200 kJ TE).9

The vitamin and mineral needs of children increase with their age. Generally, a well-planned and varied diet should meet the vitamin and mineral needs of children.2 It is important to include and eat micronutrient-dense foods and to choose fortified staples and breakfast cereals, if financial circumstances allow.

**ADHD and nutrition**

The relationship between food additives and behaviour is clinically relevant in individual children, particularly those with a tendency towards hyperactivity.10-13 Recent trials showed a benefit in dietary zinc supplementation for measured brain responses,12,13 especially in children with mothers who are poorly educated.14

There is an association between low serum ferritin and attention-deficit hyperactivity disorder (ADHD),15,16 and this has been reported to correlate with more severe ADHD symptoms.17-19 Iron supplementation studies have reported significant improvement in ADHD symptoms in children who take iron supplements.17 However, it is recommended that iron and zinc supplementation should only be provided to children who are deficient.20

Essential fatty acids and phospholipids are both essential for normal neuronal structure and function and must be supplied through the diet.21,22 A recent review concluded that it appears that although a link seems to exist between low LC-PUFA status and the occurrence of ADHD, the beneficial effects of nutritional supplementation have not yet been clearly demonstrated.6 Children with ADHD frequently manifest EFA deficiency symptoms, which may include dry hair and skin, eczema, recurrent infections, increased thirst and behavioural problems.20,23

**Summary and conclusion**

The effects of feeding, food composition, energy intake and dietary behaviour in several critical periods of a child’s life may be of paramount importance to health and well-being in adulthood. Parents should avoid force-feeding and overfeeding their children. Meals should be low in refined sugar, fat and saturated fat.3,5 Children aged two and older must be encouraged to gradually adopt a diet, that by the age of five reflects the following pattern of nutrient intake: 20-35% TE from total fat, less than 10% TE from saturated fat and less than 300 mg cholesterol per day.1

Therapeutic doses of iron and zinc may be indicated to treat confirmed deficiencies in ADHD. Furthermore, there is a link between low LC-PUFA status and ADHD, but the beneficial effects of supplementation have not been demonstrated.6

**Conflict of interest**

The authors declare that they have no financial or personal relationships which may have inappropriately influenced them in writing this paper.

**References**

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