Changing eating and physical activity patterns of US children

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The number of US children who are overweight has more than doubled over the last decade. This change has broadened the focus of dietary guidance for children to address nutrient overconsumption and physical activity patterns. Total fat consumption expressed as a percentage of energy intake has decreased among US children. However, this decrease is largely the result of increased total energy intake in the form of carbohydrates and not necessarily due to decreased fat consumption. The majority of children aged 5–17 years are not meeting recommendations for Ca intakes. Much of this deficit is attributed to changing beverage consumption patterns, characterized by declining milk intakes and substantial increases in soft-drink consumption. On average, US children are not eating the recommended amounts of fruits and vegetables. US adolescents become less active as they get older, and one-quarter of all US children watch ≥ 4 h television each day, which is positively associated with increased BMI and skinfold thickness. There is an urgent need in the USA for effective prevention strategies aimed at helping children grow up with healthful eating and physical activity habits to achieve optimal health.

Children: Dietary fat: Calcium: Obesity: Physical activity

The health status of US children has generally improved over the last three decades, as shown by lowered rates of infant mortality and a decline in the major deficiency diseases of the past (Public Health Service, US Department of Health and Human Services, 1994). Over the last decade, however, the number of children who are overweight more than doubled. Approximately 11% of American children are overweight and an additional 14% have a BMI between the 85th and 95th percentiles, which puts them at increased risk of being overweight (Troiana & Flegal, 1998) Hence, obesity is currently a much more prevalent condition among US children, including low-income children, than under-weight and growth retardation (McPherson *et al*. 1990; Mei *et al*. 1998). In the face of this change, dietary guidance for US children is now largely focused on issues related to nutrient overconsumption, physical activity patterns and chronic disease prevention (Kennedy & Goldberg, 1995). The present paper will examine the current eating and physical activity patterns of American children, how these patterns have changed over time, and how the dietary intake of children tracks as they get older. The impact of parents, schools and television on children's eating and physical activity patterns is addressed. Finally, the need for prevention strategies which can improve children's health through the prevention of chronic disease is discussed.

Dietary guidance for children

To date more than ten scientific organizations have issued dietary recommendations and guidelines for children over the age of 2 years. Recently, the US Department of Agriculture (1999) took the original widely-recognized Food Guide Pyramid (US Department of Agriculture, 1992) and adapted it for young children aged 2–6 years (Fig. 1). The nutrition messages in the children's pyramid are the same as those in the original Food Guide Pyramid. However, the foods pictured are those commonly eaten by 2- to 6-year-old children, the food group names are shorter, and illustrations of active children show the importance of physical activity. The food choices of most US children do not meet the recommended intake of food groups outlined in the Food Guide Pyramid (Lytle *et al*. 1996). The percentage of 2- to 19-year-olds who do not meet recommendations ranges from approximately 70 % for fruits, grains, meats and dairy products to approximately 64 % for vegetables (Munoz *et al*. 1997).

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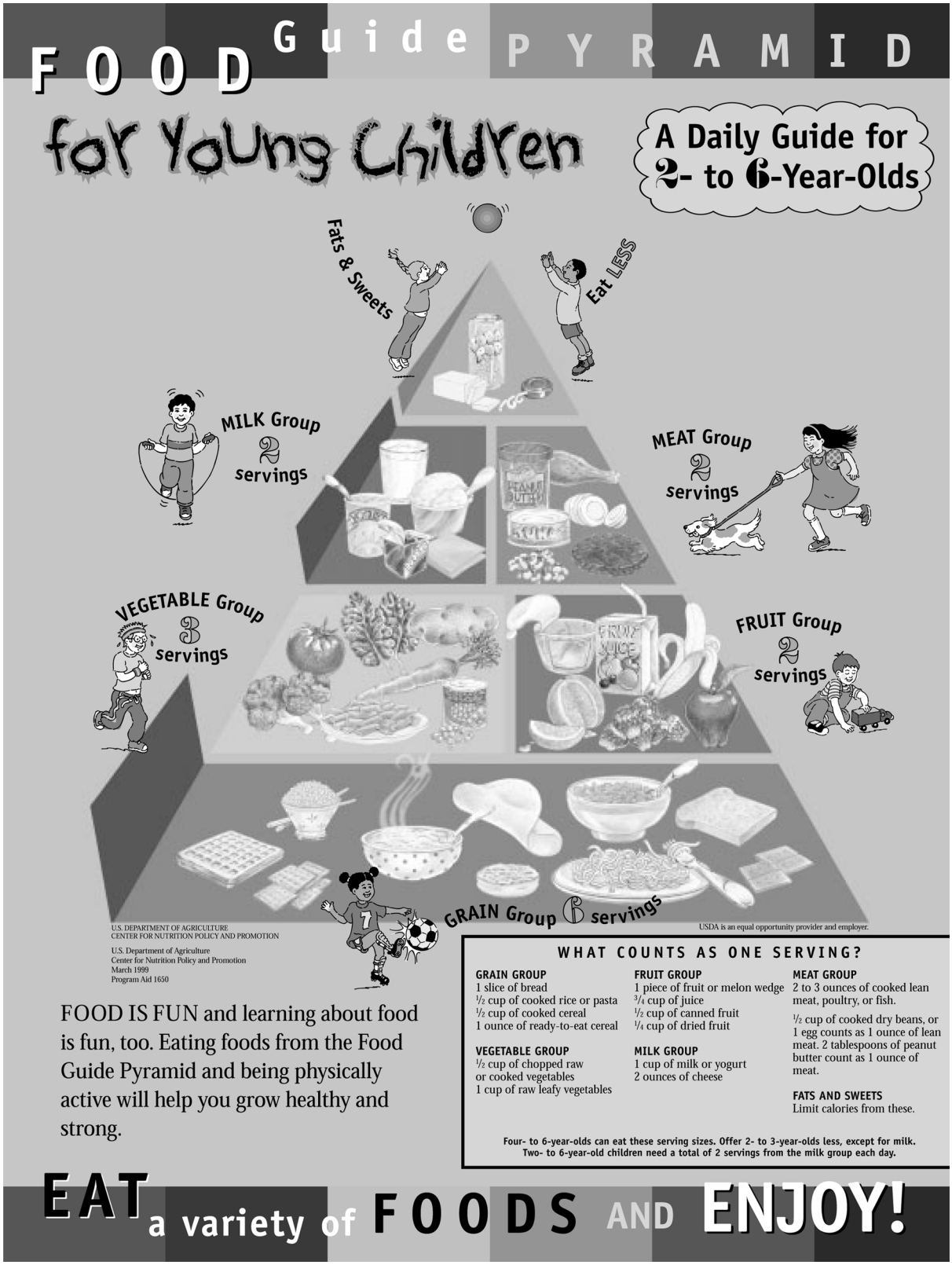

Fig. 1. Food Guide Pyramid for young children. (From US Department of Agriculture, 1999.)

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Trends in dietary intake patterns

Dietary fat

One of the most hotly debated issues in paediatric nutrition has centred around recommendations for fat intakes (Kasmin-Karakas, 1998). The precise percentage of dietary fat intake needed to support normal growth and development while still reducing atherosclerosis risk is not known. Thus, the American Academy of Pediatrics Committee on Nutrition (1998) currently recommends that children older than 2 years gradually adopt a diet that by the age of 5 years reflects the following pattern of nutrient intake: saturated fatty acids should be less than 10 % total energy; total fat over several days should be no more than 30 % total energy and no less than 20 % total energy.

Fig. 2 uses US Department of Agriculture food consumption survey data to examine trends in children's fat intake over the last 8 years. When total fat intake is expressed as a % total energy, a steady decline between 1987 and 1995 is apparent. In 1987 average fat intakes were 36 % energy intakes, while in 1995 fat intakes had declined to 33 % energy intakes. As a result, the percentage of children meeting the US Dietary Guidelines for fat increased over this 8-year time frame, with 30 % of American children meeting the guideline in 1994–5 (Wilson *et al*. 1997). The disappointing aspect of this trend is that total fat intake (g) has not declined and has actually increased in some-age-groups (Fig. 3). Absolute fat intake remained unchanged or increased in various gender and age-groups, while total energy intake was increasing. For example, for male adolescents energy intake increased from 10·1 MJ (2 425 kcal) in 1989–1991 to 11·3 MJ (2 698 kcal) in 1994–5 (Morton & Guthrie, 1998). The source of this increase in energy intake was largely from carbohydrates, and is attributed primarily to increased soft-drink consumption, especially among male adolescents (Morton & Guthrie, 1998). A higher level of energy consumed will reduce the calculated percentage of energy from fat even when there is no decrease in total fat consumption (Anand & Basiotis, 1998).

The appropriateness and safety of applying dietary recommendations for fat to young children is still debated (Williams *et al*. 1998). Numerous studies have been conducted to assess the feasibility, efficacy and safety of lowering children's dietary fat intake in an effort to determine if the dietary guideline to limit total energy from fat to 30 % is appropriate for children over the age of 2 years.

Computer-modelling studies have proposed changes showing that the recommended dietary allowances for most minerals, vitamins, trace elements, protein and energy can be met within a fat-reduced balanced diet, without major changes in meal patterns and dietary habits (Peterson & Sigman-Grant, 1997). These authors showed that exclusive use of selected fat-reduction strategies (i.e. non-fat milk instead of reduced-fat or whole milk, lean meats instead of higher-fat meats, or fat-modified products instead of full-fat products) can facilitate achievement of the current dietary recommendations in children.

Several paediatric intervention studies support the safety of fat-modified diets in children. The Special Turku Coronary Risk Factor Intervention Project for Babies (STRIP) study conducted in Finland (Niinikoski *et al*. 1997) examined the effect of a low-saturated-fat diet on growth during the first 3 years of life. The investigators found that a supervised low-saturated-fat low-cholesterol diet had no influence on growth during the first 3 years of life. In the USA, the Dietary Intervention Study in Children (DISC; Obarzanek *et al*. 1997) assessed the efficacy and safety of lowering dietary intake of total fat, saturated fat and cholesterol in hyperlipidaemic children aged 8–10 years. The intervention achieved modest lowering of LDL over 3 years, while maintaining growth, Fe stores, nutrition adequacy and psychological well-being. Finally, the Child and Adolescent Trial for Cardiovascular Health (CATCH; Luepker *et al*. 1996) was a controlled trial conducted with more than 5000 initially third-grade students. The students lowered their self-reported fat intake from 33 to 30 %

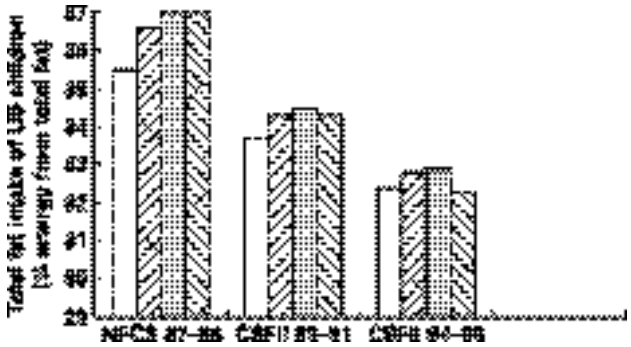

Fig. 2. Total fat intake of US children as a percentage of total energy intake. NFCS 87–88, US Department of Agriculture (USDA) Nationwide Food Consumption Survey 1987–8 (US Department of Agriculture, Human Nutrition Information Service, 1991); CSFII 89–91, USDA Continuing Survey of Food Intakes of Individuals 1989–1991 (US Department of Agriculture, Agricultural Research Service, 1995); CSFII 94–95, USDA Continuing Survey of Food Intakes of Individuals 1994–5 (Wilson *et al.* 1997). (▭), 2–5 year olds; (▨), 6–11 year olds; (▬), 12–17-year-old boys; (▧), 12–17-year-old girls.

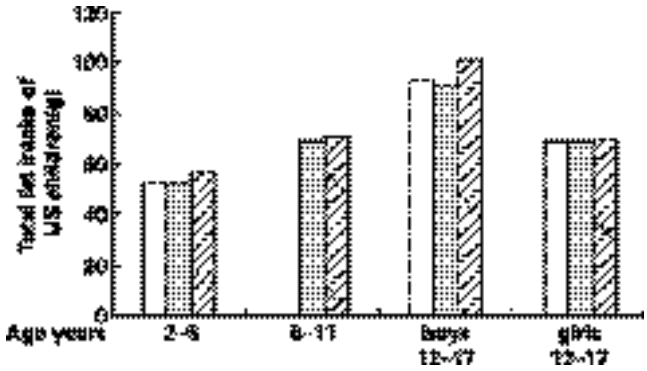

Fig. 3. Total fat intake (g) of US children. (▭), US Department of Agriculture (USDA) Nationwide Food Consumption Survey 1987–8 (US Department of Agriculture, Human Nutrition Information Service, 1991); (▬), USDA Continuing Survey of Food Intakes of Individuals 1989–1991 (US Department of Agriculture, Agricultural Research Service, 1995; (▨), USDA Continuing Survey of Food Intakes of Individuals 1994–5 (Wilson *et al.* 1997).

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energy from fat with no evidence of deleterious effects on growth or development. Thus, the body of research evidence now indicates that children can safely consume a diet conforming to current dietary recommendations for fat. There is no evidence that children's diets which contain adequate energy and 30 % total energy from fat have any negative health effects.

Calcium

Recently the USA and Canada jointly established dietary reference intakes for Ca (Food and Nutrition Board, 1997). The dietary reference intake for Ca is 500 mg for 1–3 year olds, 800 mg for 4–8 year olds, and 1300 mg for 9–18 year olds. These levels are substantially higher than the 1989 recommended dietary allowances for Ca (Food and Nutrition Board, 1989). The levels were raised by 500 mg for 9–10 year olds and by 100 mg for 11–18 year olds. The change was based primarily on evidence that Ca intakes above the 1989 recommended dietary allowances can increase bone mineral density in children (Johnston *et al*. 1992; Chan *et al*. 1995), thus decreasing their risk of developing osteoporosis later in life (Matkovic & Ilich, 1993).

Unfortunately, at the same time as the dietary reference intakes are recommending increased Ca intakes, the majority of children age 5–17 years are not even meeting the previous recommendations (Wilson *et al*. 1997). Ca intake is especially problematic for US girls, with 59 % of girls in the 6–11 years age-group and 86 % of girls aged 12–18 years not meeting the 1989 recommended dietary allowance for Ca (Wilson *et al*. 1997).

Milk and dairy products provide the most important source of Ca in children's diets, as they account for 75 % of the Ca in the US food supply (Kennedy & Goldberg, 1995). However, major changes in beverage consumption patterns of US children have occurred over the last two decades. Mean consumption of all milk products declined from 422 to 396 g between 1989–91 and 1994–5 (Morton & Guthrie, 1998). Whole-milk consumption declined, low-fat milk consumption remained stable, and consumption of skim-milk and other dairy products (e.g. cheese, ice cream, puddings) rose (Morton & Guthrie, 1998). At the same time, the largest increase in beverage consumption occurred with soft drinks. Soft-drink consumption increased from 198 g/d in 1989–91 to 279 g/d in 1994–5 (Morton & Guthrie, 1998). For male adolescents soft-drink consumption rose to 580 g (19·33 oz)/d. Annual food supply data show that in the USA *per capita* consumption of regular soft drinks increased from 83·3 l (22 gallons) in 1970 to 151·4 l (40 gallons) in 1994 and 155·2 l (41 gallons) in 1997 (Gerrior *et al*. 1998). Consumption of tea and breakfast drinks, fruitades, non-fruit drinks and powdered drink mixes increased during the same time period (Morton & Guthrie, 1998). In 1945 Americans drank more than four times as much milk as soft drinks, while in 1997 they drank nearly 2·5 times more soft drinks than milk (Fig. 4; Gerrior *et al*. 1998). Some of the increase in soft-drink consumption may be attributable to the growing size of a single-serving container. In the 1950s, a 192 ml (6·5 oz) bottle was the standard serving. The standard serving then became a 355 ml (12 oz) can, and

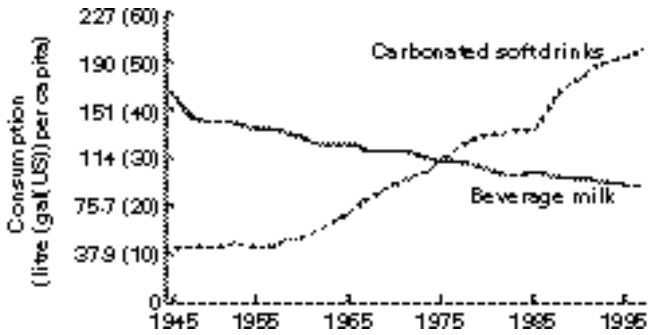

Fig. 4. American carbonated soft drink and milk consumption 1945–1997. 1947 is the earliest year for which data on soft-drink consumption are available. *Per capita* consumption of milk reached an all-time high in 1945 (data series dates from 1909). (From Gerrior *et al.* 1998.)

these cans have now been supplanted by 710 ml (20 oz) bottles. The larger the container the more beverage children are likely to drink, especially when they assume they are consuming a single-serving container (Jacobson, 1998).

On average, only those children with a source of milk in their diets come close to meeting Ca recommendations (Johnson *et al*. 1998). Thus, the ongoing trend for Ca-rich beverages to be displaced by beverages high in added sugars is of concern for children. Harnack *et al*. (1999) demonstrated that children who are high consumers of soft drinks have lower intakes of riboflavin, folate, vitamin A, vitamin C, Ca and P in comparison with children who are non-consumers of soft drinks. Along with Ca, several of these nutrients (folate and vitamin A) have been identified in US national surveys as 'shortfall' or 'problem' nutrients (US Department of Agriculture, 1998). There is concern that the message to 'eat less fat' cannot be translated to 'drink less milk' (Johnson *et al*. 1998). Nevertheless, the trend for higher-fat milks to be replaced with lower- or non-fat milks is encouraging.

Fibre, fruits and vegetables

Ideal fibre intakes for children have not been defined. However, the American Health Foundation has recommended that children older than 2 years should increase dietary fibre intake to an amount equal to or greater than their age plus 5 g/d to achieve the recommended intake of 25–35 g/d after the age of 20 years (Williams, 1995).

Current average dietary fibre intake among children ranges from 11·2 g/d (3- to 5-year-olds) to 14·0 g/d (6- to 11-year-olds; Gerrior *et al*. 1998), and these levels have remained virtually unchanged since 1976 (Alaimo *et al*. 1994; Nicklas *et al*. 1995). Vegetables, soups and fruit contribute approximately 40 % of the total dietary fibre intake of 10-year-olds (Nicklas *et al*. 1995).

In practical terms dietary fibre recommendations have been translated to the 'five a day' message which encourages children to eat five servings of fruits and vegetables each day. On average, US children are not eating the recommended amounts of fruits and vegetables (Kirby *et al*. 1995; Baranowski *et al*. 1997; Wilson *et al*. 1997). Of

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children aged 6 to 11 years 91 % are not consuming the recommended five servings or fruits and vegetables per d, averaging just 2·5 servings daily.

Trends in physical activity patterns

Physical activity is an important component of any effort to reverse the trend of increasing obesity in children and osteoporosis later in life (Troiana *et al*. 1995; Ulrich *et al*. 1996). Although US children are more active than adults, a Centers for Disease Control and Prevention (1996) survey showed that 48 % of girls and 26 % of boys do not exercise vigorously on a regular basis. At the same time, participation in school-based physical education is declining; daily enrolment dropped from 42 % of students in 1991 to 25 % of students in 1995. Adolescents become less active as they get older, with only one-third of older teenage girls participating regularly in vigorous physical activity (Fig. 5; US Department of Agriculture, Food and Nutrition Service, 1998). In addition, one-quarter of all US children watch ≥ 4 h television each day, and the no. of h television watched is positively associated with increased BMI and skinfold thickness (Andersen *et al*. 1998).

In 1997, Centers for Disease Control and Prevention (1997) published guidelines for school and community programmes aimed at promoting physical activity among young people. Included in the guidelines are a recommendation for daily physical education in schools, and suggestions on how to modify the focus from competitive sports toward emphasizing an active lifestyle through enjoyable participation in physical activity. Clearly there is nothing wrong with competitive youth athletic programmes, but these programmes cannot serve the needs of all children. Programmes need to be broadened to include activities that appeal to all children, not just those who are athletically gifted. Several organizations have developed activity or fitness pyramids similar to the US Department of Agriculture Food Guide Pyramid to promote regular activity among children (Johnson & Nicklas, 1999).

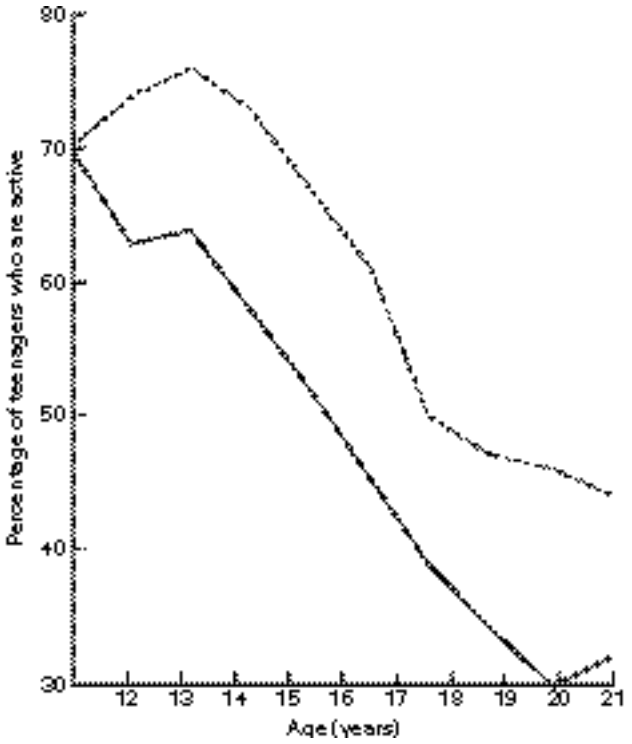

Fig. 5. Percentage of US adolescents and young adults who participate regularly in vigorous physical activity. (-----), Males; (——), females. (From US Department of Agriculture, 1998.)

Tracking of nutrient intake in children

Tracking is a term used to indicate the likelihood that a child will remain in a respective rank for nutrient intake in relation to his (her) peers. Data from Singer *et al*. (1995) suggest that tracking begins as early as 3–4 years of age. Milk consumption during childhood tracks over time, affecting lifetime milk consumption. Among a sample of elderly adults, the frequency of milk consumption during childhood was found to be the strongest predictor of current milk intake (Elbon *et al*. 1996). Kelder *et al*. (1994) studied sixth graders up to the twelfth grade (11–17 years) and found that food preferences tracked well over this time period. Hence, it has been suggested that health promotion interventions should begin before the sixth grade, before these patterns become resistant to change (Kelder *et al*. 1994).

The role of parents and caregivers in developing healthy eating behaviours

Parents have a major impact on their children's eating and physical activity patterns. Nutrient intakes are known to aggregate in families, with the strongest associations found between mothers and their children (Oliveria *et al*. 1992). For example, mothers' milk consumption has been shown to be the best predictor of US children's milk intake (CV Panely, RK Johnson and MQ Wang, unpublished results).

It is well known that children's food preferences are a major determinant of their food selection, i.e. 'children won't eat what they don't like' (Birch & Fisher, 1995). It is important to realize, however, that children's food preferences are learned through repeated exposure to foods. With a minimum of eight to ten exposures to a food, children will develop a clear increase in preference for that food (Birch & Marline, 1982). Thus, parents and other child caregivers can provide opportunities for children to learn to like a variety of nutritious foods by exposing them to these foods.

Young children are known to adjust their meal size according to the energy density of the food available (Birch & Deysher, 1986), and are able to adjust their food intake across successive meals to tightly regulate energy intake for 24 h periods (Birch *et al*. 1991). However, child feeding practices have been shown to influence children's responsiveness to energy density and meal size (Birch & Fisher, 1998). When parents assume control of meal size or coerce children to eat rather than allowing them to focus on their internal cues of hunger, children's ability to regulate meal size in response to energy density is diminished (Johnson & Birch, 1994). This factor seems especially

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problematic among girls with a high BMI (Johnson & Birch, 1994).

Television and children's food-consumption patterns

It is evident that television food advertisements aimed at children are generally contrary to what is recommended for healthful eating for children (Kotz & Story, 1994). The most-commonly-advertised foods correlate well with the most-frequently-requested foods by children. These foods include sweetened breakfast cereals, sweets, desserts, low-nutrient beverages and salty snack foods (Kotz & Story, 1994). This finding raises an important public health issue that has to be addressed at a national level.

Conclusion

Most US children do not meet the US Department of Agriculture Food Guide Pyramid recommendations, especially for the fruit, grain, and dairy groups (Munoz *et al*. 1997). The majority of US children do not meet guidelines for total and saturated fat. Beverages and foods high in added sugars (i.e. soft drinks) are displacing more-nutrient-dense foods (i.e. milk) in children's diets (Harnack *et al*. 1999) resulting in alarmingly low Ca intakes, particularly among adolescent girls (US Department of Agriculture, 1998). Participation in regular vigorous physical activity declines as children get older, and the number of US schools who offer daily physical education is diminishing (Centers for Disease Control and Prevention, 1996). At the same time, an estimated one in five American children are now overweight (Troiana *et al*. 1995), putting them at risk of serious health, economic and quality of life consequences (Anand *et al*. 1999). There is an urgent need in the USA for the implementation of effective prevention strategies aimed at helping children grow up with healthful habits. Establishing lifelong habits of regular enjoyable physical activity and healthful food choices has the potential for a major impact on the future of adult chronic diseases (Johnson & Nicklas, 1999).

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