



Cooperative Extension

CHILDHOOD OBESITY PREVENTION LITERATURE REVIEW - 2006

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Funding for this project was provided by CSREES-USDA. The Cooperative Extension System (CES) is a publicly funded, non-formal educational network that links the resources and activities of the U.S. Department of Agriculture (USDA) Cooperative State Research, Education, and Extension Services (CSREES), 1862 and 1890 (Historically Black Colleges) land-grant institutions, 1994 institutions (Tribal Colleges) and more than 3,000 county administrative units. Land-grant colleges and universities are located in all 50 states, the U.S. Territories, and the District of Columbia.

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## MEASUREMENT ISSUES

Body mass index (BMI) is recommended as the standard measure of fatness in children two years of age and older (American Academy of Pediatrics, 2003; Cole, Bellizzi, Flegal & Dietz, 2000; de Onis, 2004). BMI is weight in kilograms divided by the square of height in meters.

While measuring BMI promotes early identification of children at risk for obesity because it correlates well with accurate measures of body fatness (Pietrobelli et al., 1998), BMI is not a perfect approximation of excess adiposity because it varies by race and gender (Daniels, Khoury, & Morrison, 1997). Using more than one measurement technique may be needed for an accurate assessment, particularly in children of non-Caucasian descent (Chai et al., 2003). CDC charts account for differences in gender but not race or ethnic group. BMI must be measured over time to depict a child's growth pattern.

For both sexes, BMI s at the levels which are considered "at risk of overweight" and "overweight" decline slightly from age 2 until age 5.5 and then rise gradually. By age 18, youth BMI categories are the same as those used with adults: 25-29.9 for overweight and 30 and above for obese (Cole et al., 2000).

Other measures are skinfold thickness (most commonly used) and waist, hip and thigh circumferences. Body composition can also be measured by bioimpedance analysis (BIA) and dual energy X-ray absorptiometry (DXA) (Pietrobelli, 2004).

## PREVALENCE

The terms "obese," "overweight," and "at risk for overweight" have not been used consistently in the research literature regarding children and adolescents. Children and adolescents identified as overweight have a body mass index (BMI) at or above the 95<sup>th</sup> percentile of the sex-specific BMI -for-age growth charts. Prevalence rates (percentages) for child *overweight* found in the National Health and Nutrition Examination Survey (NHANES) from 1999-2002 were reported by Hedley et al. (2004, p. 2848):

Ages in years	All	Non-Hispanic White	Non-Hispanic Black	Mexican American
2-5	10.3	8.6	8.8	13.1
6-11	15.8	13.5	19.8	21.8
12-19	16.1	13.7	21.1	22.5

In the 1999-2000 data, Mexican American boys aged 6 to 19 years had a significantly higher prevalence rate for overweight than non-Hispanic white or black boys (Hedley et al., 2004). The Healthy People 2010 target goal for prevalence of overweight in children 6-19 years of age is 5% (U.S. Dept. of Health and Human Services, 2000).

Children and adolescents at risk for overweight are between the 85<sup>th</sup> and 95<sup>th</sup> percentile on the growth charts. Prevalence rates for *risk of overweight* reported from the same survey data (Hedley et al., 2004, p. 2848) were:

Ages in years	All	Non-Hispanic White	Non-Hispanic Black	Mexican American
2-5	22.6	20.8	23.2	26.3
6-11	31.2	28.6	33.7	38.9
12-19	30.9	27.9	36.8	40.7

In a report to the World Health Organization, Lobstein, Baur and Uauy (2004) noted that approximately 0.5% is being added to the prevalence rates of childhood obesity each year.

“The time to overweight during childhood and adolescence varies by race, indicating the need for race-specific timing of interventions” (Saha, Eckert, Pratt & Shankar, 2005, p 2648). A quarter of the black children were at risk for overweight or were overweight at or before the age of 7, but that percentage was not reached among white males until age 10 and among white females until age 11. These researchers stress the importance of prevention efforts beginning early and being tailored to the needs of specific populations.

This conclusion is supported by another study of 3,022 children followed from birth to age 7. Salsberry and Reagan (2005) found that African-American and Hispanic children were at greater risk than White children for being overweight at young ages and that there was a persistent effect at later measurement points of this early weight status (i.e., the most significant risk factor for overweight status at the second and third measurement points was overweight at a previous time of measurement).

## CAUSAL AGENTS

“To promote obesity, both genetic and environmental factors must influence one or more components of energy balance” (Pietrobelli, 2004, p. 586).

The obesity epidemic among adults has occurred in the entire population but has been stronger at the upper end of the distribution of body mass index (BMI), suggesting that a subgroup of the population is more susceptible to these influences (Flegal & Troiano, 2000). The lower tail of the distribution of BMI has been virtually unchanged for children and, to some extent, adolescents and young men. The fact that the main effect for children and adolescents is in the upper end of the distribution (i.e., heavier individuals becoming heavier) suggests that there is a similar susceptibility (genetic or social) to changes in the environment among youth (Daniels et al., 2005).

However, genetic changes within a population do not occur rapidly enough to explain the acceleration of obesity among children (Flegal & Troiano, 2000; Jeffery & Utter, 2003). Not all children born to obese parents become obese (Whitaker et al., 1997).

In developed countries, differences in overweight and overweight trends occur by social class and by ethnic group (Gordon-Larsen, Adair & Popkin, 2003; Strauss & Pollack, 2003). Because the change in BMI has occurred across the adult population, the cause is unlikely to be due to immigration and emigration or to the changing racial and ethnic population in the U.S. (Flegal & Troiano, 2000).

"The rapid increase in obesity in Americans provides strong evidence that, whatever the genetic liability, environmental influences play a key role in its development" (Faith et al., 2004, p. e429).

Researchers have studied metabolic processes that may be causal agents of obesity. "Metabolic programming" occurs during embryonic and fetal development when adverse conditions, such as poor nutrition or exposure to toxic elements, cause the organism to adapt at the cellular, molecular, and biochemical levels to sustain growth. "Such early adaptations to a . . . stress/stimulus permanently change the physiology and metabolism of the organism and continue to be expressed even in the absence of the stimulus/stress that initiated them" (Patel & Srinivasan, 2002, p. 1629). A related hypothesis, the thrifty phenotype hypothesis, posits that the "catch-up" growth often experienced by low birthweight babies is related to childhood obesity and the manifestation of latent diseases in adulthood as a result of metabolic programming (Hales & Ozanne, 2003). The "Barker hypothesis" postulates that embryonic and fetal programming "determines the set point of physiological and metabolic responses that carry into adulthood" and contributes to type II diabetes, hypertension and cardiovascular disease (Lau & Rogers, 2004, p. 300).

Rose and Day (1990) have shown that health characteristics such as blood pressure or serum cholesterol move up and down as a whole so that the mean predicts the number of affected people. Their model suggests that prevention efforts targeting these conditions should be focused on the population, rather than individuals. Based on the shift to the right in the distribution of BMI in the population, Flegal and Troiano (2000) conclude that the causes should be investigated in part at the population level, not the individual level, because the changes in behavior are likely to be social and environmental in nature. Baughcum et al. (2001) conclude that "there is a strong 'nurture' component to childhood obesity that begins at birth and remains poorly understood" (p. 391).

## **ENERGY BALANCE**

"Our human ancestors developed multiple and redundant biologic systems that encouraged us to eat when food was available and conserve energy when expending it was not required to meet basic survival needs" (Peters, 2004, p. 112). Addressing the epidemic requires "cognitive control over the current environmental pressures to eat and be sedentary" (Peters, 2004, p. 114).

Excessive weight gain occurs when energy intake exceeds energy output, but the relative importance of energy intake versus energy output remains controversial (Jeffery & Utter, 2003). The energy intake and expenditure equation is not as simple for infants, children and adolescents because they need about 2% greater energy intake than output to support

development (Parsons, Power, Logan & Summerbell, 1999). Restriction of calories as an obesity prevention measure must be carefully supervised. Youth too need physical activity for proper development, but they have different patterns than adults (Blair, 2003).

Research on obesity prevention is complicated by the difficulty in measuring small imbalances in energy intake and energy expenditure (Leibel, Rosenbaum & Hirsch, 1995; Wells, 1998). Skinner et al. (2004) underscore the complexity of prevention efforts because there are multiple potential causes: genetics, dietary excesses, lack of physical activity, parental obesity, birth weight and infant fatness, duration of breastfeeding, parental feeding styles, age of adiposity rebound, previous overweight, socioeconomic status, ethnicity, time spent on media use, and short sleep duration.

## GENETIC PREDISPOSITION

Genetic influences on weight are not modifiable risks (unless what is happening to genetic expression *in utero* can be considered modifiable), but recognition of genetic predisposition to obesity is an important consideration in prevention efforts. In an obesogenic environment, children who have a predisposition to obesity are at significant risk of experiencing a gene-environment interaction. An obesogenic environment is defined as “the sum of influences that the surroundings, opportunities, or conditions of life have on promoting obesity in individuals or populations” (Swinburn, Egger & Raza, 1999, p. 564).

Genetic factors which predispose children to obesity may include (Douchis, Hayden & Wilfley, 2001; Lumeng, 2005):

- Metabolic rate
- Parental BMI – Studies examining the potential genetic effects of maternal BMI on children from birth through preschool age have been inconclusive. One study suggests that genetic influences on children's weight may be independent of those that influence BMI in adults (Stunkard, Berkowitz, Stallings & Cater, 1999).
- Behavioral predispositions to food preferences, such as sweet or high fat foods
- Patterns of physical activity
- Early puberty

The metabolic syndrome (also known as insulin-resistance syndrome) is a cluster of traits that include hyperinsulinemia, obesity, hypertension, and hyperlipidemia and is found in 30-50% of overweight children. It is “believed to be triggered by a combination of genetic factors in combination with environment factors such as excess calorie intake and reduced levels of physical activity” (Daniels et al., 2005, p. 2002). Genetic conditions associated with obesity include, but are not limited to, Prader-Willi syndrome, Bardet-Biedl syndrome, and Cohen syndrome (American Academy of Pediatrics, 2003).

A pediatric twin study found significant genetic influence on percent of body fat apart from BMI. A greater understanding of the genetic and environmental determinants of body

composition in children and adolescents is needed to enhance obesity prevention efforts (Faith et al., 1999).

## **ENVIRONMENTAL EFFECTS ON ENERGY BALANCE**

Caballero (2004) summarized characteristics of the obesogenic environment which warrant study in relation to energy balance:

- 1) wide availability of inexpensive, high-energy density foods
- 2) increasing opportunities to consume food throughout the day;
- 3) reduced energy demands of daily activities (automobile, elevators, escalators)
- 4) increasingly sedentary leisure time (TV, video, movies)
- 5) limited opportunities for recreational physical activity (lack of safe open spaces, time demand from work)

## **ENERGY INTAKE**

" . . . research on obesity prevention still lags behind, likely because of the extremely complex set of factors determining excess weight gain, and the multiple social, cultural, and economic elements linked to human food intake behavior" (Caballero, 2004, pg. 591).

## **SOCIETAL TRENDS**

Although there are some fluctuations apparent in U. S. Department of Agriculture (USDA) surveys of food consumption in representative populations from 1965 to 1995 (Harnack, Jeffery & Boutelle, 2000; Popkin, Siega-Riz, Haines & Jahns, 2001), "individual-level data on diet show essentially no change in energy intake during a period when the average body weight increased by about 5 kg [11 lbs.]" (Jeffery & Utter, 2003, pg. 13S).

Analysis of food consumption may be inaccurate for several reasons: (Jeffery & Utter, 2003)

- possibility of increased underreporting because of the social stigma of being overweight
- secular trends in larger typical portion sizes that are not accounted for in dietary assessment methods
- consumption of higher proportions of food when eating away from home
- inaccuracy of nutrient databases for foods consumed outside the home
- technical changes in assessment methods

While food consumption survey data do not track well with weight gains, aggregate data for per capita availability of food energy in the U.S. do. Per capita availability of food energy was stable between 1970 and 1980, a period when weights remained stable. An increase which began about 1980 has resulted in per capita availability of food energy being about 15% higher than it was in 1970 (Jeffery & Utter, 2003). The dramatic increase in per

capita carbohydrate availability and decrease in per capita fat availability between 1970 and 1995 helps to explain “declining serum cholesterol levels and declining cardiovascular disease rates, despite increases in body weights” (Jeffery & Utter, 2003, pg. 14S).

Data on temporal trends in per capita availability of specific foods (e.g., red meat, chicken, butter) may provide clues to the obesity epidemic. Documented temporal trends in availability of food and convenience over the last 25-30 years include: (Jeffery & Utter, 2003).

- Increased number of locations where ready-to-eat foods are available
- Increased proportion of food dollars spent away from home (Kant & Graubard, 2004).
- Preference for restaurants with limited menus, quick service, and the option for take-out
- Increased distribution of food through vending machines
- Increased proportion of foods available in traditional food stores geared to ease of preparation
- Increases in portion and packaging size, which began in the 1970s, rose sharply in the 1980s, and continued to increase as body weights have risen (Young & Nestle, 2002)

A significant factor is the wide availability of high-energy density, inexpensive foods.

- High-fat foods have high energy density because they provide more energy per gram than other nutrients. Studies show that energy intake varies with energy density when fat intake is held constant (Stubbs, Harbron, Murgatroyd & Prentice, 1995. “Although not all energy-dense foods are high in fat, few high-fat foods are low in energy density” (Hill & Peters, 1998, pg. 1371).
- An unhealthy diet, high in saturated fat and low in fresh fruits and vegetables, is less expensive than a healthy diet. “The highest rates of obesity occur among population groups with the highest poverty rates and the least education . . . The association between poverty and obesity may be mediated, in part, by the low cost of energy-dense foods and may be reinforced by the high palatability of sugar and fat” (Drewnowski & Specter, 2004, p. 6).

However, a more recent analysis of data from the 1997 Child Development Supplement (CDS) to the Panel Study of Income Dynamics (PSID) concluded that “Children in poor and high-income families are less likely to be overweight whereas children in near-poor and working-class families are more likely to be overweight than those in moderate-income families” (Hofferth & Curtin, 2005, p. 722). The researchers speculate that poor families have a lower quantity of food and high income families have better quality, whereas the near-poor and working-class families may have greater quantities of lower quality foods. In addition to income, these conditions could reflect differential access to foods and to information about food.

Although the cost of food as a percent of income has steadily declined, it continues to consume a larger proportion of the budget in lower income families. Greater affordability

probably results in greater food consumption, but the decline in food prices cannot account for the changes in body weight trends (French, Story & Jeffery (2001).

Guidelines for Americans (USDA, 2005) encourage consumption of nutritious foods and reduction of foods high in fat, cholesterol, sodium and sugar, along with recommendations to eat less. MyPyramid enables adults to determine appropriate amounts of food intake based on activity level, gender, and age and to get the most nutrition out of the calories consumed. Online it is at <http://www.mypyramid.gov> . A link to the Spanish version is in the upper right corner – En Espanol.

The Start Healthy Feeding Guidelines for Infants and Toddlers cover dietary needs from birth to 24 months (Butte et al., 2004). Dietary guidance for healthy children ages 2 to 11 years published by the American Dietetic Association (2004) discusses the nutrition needs of children to support growth and development and reviews current eating habits among children, dietary trends, and the impact of school meals on children's diets. MyPyramid for Kids provides attractive materials to encourage children 6-11 years of age to learn about and practice good dietary and exercise habits. It can be accessed at <http://teamnutrition.usda.gov/kids-pyramid.html> .

## **PARENTING BEHAVIORS**

“Parental styles of child feeding are not random; they are elicited in part by child characteristics, including overweight and current weight status” (Faith et al., 2004, pg. e435)

“Compared with assessing dietary intake, it is possible that the maternal feeding practices and beliefs describing the context of child feeding may be easier to measure, more predictive of childhood obesity, and more suitable targets for the counseling of parents about obesity prevention” (Baughcum et al., 2001, p. 392).

An understanding of feeding practices is important because they are potentially modifiable behaviors. However, caution is warranted.

“Without scientific evidence that particular child-feeding practices either promote or protect against later obesity, making recommendations about practices to prevent childhood obesity may be premature. The possible harm in such recommendations may be that they unnecessarily interfere with the mother-child feeding relationship. That relationship remains central to mother-child attachment and contributes to self-efficacy in the mother in the broader role of parenting and nurturing her child” (Baughcum et al., 2001, p. 397).

Differences in feeding practices between lower- and upper-income mothers have been documented, but there is no proof that either approach is related to the risk of child overweight. Differences may reflect sociocultural factors. “Professionals have no basis on which to make a value judgment about these practices as they pertain to child overweight outcomes” (Lumeng, 2005, p. 18), and the author cautions that urging parents to change

their feeding practices when we have little scientific evidence to suggest that these are actually “wrong” may alienate mothers from health care providers.

In a study with lower- and upper-income mothers in Belgium, Germany and the Netherlands, higher class mothers restricted more unhealthy foods but prescribed as many healthy foods as lower class mothers. Higher class mothers reported health considerations more frequently as the basis for food choices, whereas lower class mothers reported family taste preferences, perhaps reflecting concerns about limited resources and waste if food was rejected. Lower class mothers permitted more snacking between meals as long as children ate at main meals (Hupkens, Knibbe, van Otterloo & Drop, 1998).

Baughcum et al. (2001) did find differences between feeding practices of lower- and upper-income mothers of infants. Lower-income mothers

- were less likely to use food to calm an infant
- were more concerned about the child’s hunger
- reported a higher degree of structured feeding, but that might reflect less breastfeeding.

In a similar study with mothers of preschool children 2-5 years of age, Baughcum et al. (2001) found that lower income mothers

- reported less structured meal time, which may reflect a more chaotic environment involving more competing demands and external stressors,
- reported greater difficulty in feeding their children and more often pushing their child to eat more, and
- engaged in more age-inappropriate feeding (e.g., children eating in front of the TV, walking around while eating instead of sitting at table); but none of these practices was associated with increased risk of obesity at age 5.

Across both studies reported in Baughcum et al. (2001), low-income mothers were three times more likely to be obese as upper-income mothers. Low-income children were twice as likely to be overweight as the upper-income children.

Overfeeding by obese mothers is a potential pathway to obesity (Whitaker et al., 1997). Although Baughcum et al. (2001) found that the level of concern about infants’ *undereating* and becoming underweight was higher among obese mothers, there was no evidence that their infants were overweight by age 1. This finding is consistent with other studies finding no relationship between mothers’ obesity and children being overweight before age 3 (Stunkard et al., 1999).

Over all, mothers’ concern about *overfeeding* was low, although there was a positive association between infant overweight and maternal concern with overfeeding for fear of obesity, which was stronger among high-income mothers (Baughcum et al., 2001). Independent of the mother’s or child’s weight, low income mothers express concern about infants’ hunger and report difficulty refusing food to older children when they say they are hungry, even if they have just eaten a meal (Baughcum et al., 2001; Jain et al., 2001).

## Breastfeeding

Breastfeeding reduces infant mortality and illness and may protect against obesity, Sudden Infant Death Syndrome, some forms of diabetes, and several other diseases. Exclusive breastfeeding is “sufficient to support optimal growth and development for approximately the first six months of life”, with iron-rich foods added gradually after that.

“Breastfeeding should be continued for at least the first year of life and beyond for as long as mutually desired by mother and child” (American Academy of Pediatrics, 2005, pg. 499).

Substantiation of a beneficial effect of breastfeeding on childhood obesity requires randomized controlled trials, which are not ethical in breastfeeding studies (Arenz, Ruckerl, Koletzko & Von Kries, 2004). As breastfeeding was being promoted by the World Health Organization in the Republic of Belarus, Kramer et al. (2002) used hospitals not yet involved in the educational effort as controls. In the treatment group hospitals, both duration and exclusivity of breastfeeding were increased. These infants had greater weight and height growth in the first three months, but prolonged and exclusive breastfeeding led to slower weight and length gains between 3 and 12 months. Butte, Wong, Hopkinson, Smith & Ellis (2000) found that breastfed and formula-fed babies exhibit different growth patterns and body fat composition in early infancy, but that the effect disappears in the second year of life.

Three recent reviews of published studies report a small to moderate protective effect of breastfeeding, although a more thorough understanding of the influence of confounding variables is needed.

- Dewey (2003) concluded that “the evidence to date suggests that breastfeeding reduces the risk of child overweight to a moderate extent” (p. 17) and is probably small compared to other influences, such as parental overweight.
- After adjusting for potential confounding factors, Arenz et al. (2004) concluded from a meta-analysis of nine studies that breastfeeding has a small but consistent protective effect against childhood obesity.
- “Overall, our results suggest that breastfeeding is protective against obesity, although the precise magnitude of the association remains unclear” (Owen, Martin, Whincup, Smith, & Cook, 2005, p. 1375). Based on other well-established benefits, such as improved neural and psychosocial development, less allergic disease, and potentially lower cholesterol levels in later life, the case for breastfeeding is strong (Owen et al., 2005).

However, other studies have concluded that the relationship between breastfeeding and childhood obesity is still unclear (Baughcum et al., 2001; Hediger, Overpeck, Kuczmariski & Ruan, 2001; Parsons et al., 1999; Parsons, Power & Manor, 2003). Among low-income children, a positive association was found only in white children (Grummer-Strawn & Mei, 2004).

Mixed findings have been reported on the effects of the duration of breastfeeding. Most of the earlier studies on the effects of duration of breastfeeding have involved small samples of non-Hispanic white children.

- Gillman et al. (2001) reported a reduction in risk for children breastfed at least 7 months, with the greatest reduction found with 9 months of breastfeeding.
- Poulton and Williams (2001) reported no benefit for breastfeeding less than 6 months but found evidence of protection at ages 9, 11, 15, and 18 years with longer periods of breastfeeding.
- In a very large multiracial, multiethnic sample of low-income families (<185% of poverty) who used Public Health services, Grummer-Strawn & Mei (2004) found that there was greater protection against being overweight at four years of age for non-Hispanic white children who had been breastfed for 6-12 months than for children who had not been breastfed, and that the benefit was even greater for children who were breastfed for more than 12 months. None of these benefits were apparent for non-white children.

From a meta-analysis of 17 studies of the effects of duration of breastfeeding on risk of overweight, Harder, Bergmann, Kallischnigg & Plagemann (2005) reported an inverse and linear association. For each month of breastfeeding, there was a 4% reduced risk of overweight during childhood, adolescence and adulthood (the latter two age groups measured only in a few studies). The effect was apparent for infants who were breastfed for up to nine months and was independent of the definition of overweight and the age at follow-up. Infants included in these studies were either partially or exclusively breastfed and were compared against exclusively formula-fed infants. [Gillman et al., (2001) and Poulton & Williams (2001) were included in this meta-analysis; Grummer-Strawn & Mei (2004) may have been published too late to be included.]

Although not significant, there was a tendency toward slightly higher rates of overweight among children breastfed for a short duration (Gillman et al., 2001; Grummer-Strawn & Mei, 2004). Dietz (2001) suggests that the benefit may not be apparent at the earlier ages, just as some animal studies have found that the effect of early feeding patterns on later overweight are not observed until a later age.

In a recently published longitudinal study of 2,087 children followed from 16 weeks of age to 8 years of age (Burke et al., 2005), babies who were breastfed for four or fewer months had the highest risk of overweight between one and eight years of age compared to children who were never breastfed or those who were breastfed for more than 4 months. Children in this high-risk group also had "the highest prevalence of maternal obesity, smoking and lower education" (p. 56). At one year of age children who had been breastfed for 12 months were the leanest group, but over the next seven years BMI z scores "associated with the duration of breastfeeding tended to converge and showed no significant differences *after adjustment for maternal factors*" (p. 59 – emphasis added).

Hebebrand, Sommerlad, Geller, Gorg & Hinney (2001) posit that some mothers who breastfeed for a short period of time (e.g., 3 months) may opt for formula because they perceive that their babies are not satisfied. In some cases, the infant may be satisfied by breastfeeding but be unable to convey that message to the mother. If the infant is indeed not satisfied, the increased hunger may have a genetic component. Giving babies supplemental formula may result in weaker sucking, further reducing the mothers' supply of milk (Kramer et al., 2002).

Gillman et al. (2001) discussed issues which could confound research to determine if breastfeeding is protective against obesity in childhood, adolescence, and adulthood. For example, are women who breastfeed for longer durations different from women who do not breastfeed? Of the many factors which can confound these studies, the first three are considered the most important (Burke et al., 2005; Owen et al., 2005).

- Maternal weight - Breastfeeding in most industrialized countries today is less common among women who are overweight than those at normal weight (Dewey, 2003). That association is related to socioeconomic factors (Dewey, 2003) and may be related to the negative association between pre-conception maternal obesity and the initiation and duration of lactation (Rasmussen, Hilson, & Kjolhede, 2001). In a sample of 151 women, Hilson, Rasmussen & Kjolhede (2004) found that, for each 1 unit increase in pre-conception BMI, the initiation of lactation was delayed by .5 hour. That delay might result in obese mothers leaving the supportive hospital environment before lactation has been established and/or being anxious about their milk supply and opting for formula feeding. The researchers speculate that obese women may "experience a delay in the fall of progesterone resulting from an elevated amount of this hormone produced by excess adipose tissue," and this slows down the secretion of prolactin upon which lactation depends (pg. 19). If an obese mother's nipples are flat, the baby may be less successful latching on and engaging in adequate suckling 3 to 4 days after birth. An analysis of data from the 1996 National Longitudinal Survey of Youth, Child and Young Adults in the United States showed that children of mothers with a BMI of 30 or greater during pregnancy who were breastfed for at least four months had a lower risk of childhood overweight compared to similar children who were not breastfed (Li et al., 2005).
- Maternal smoking - Because infants born to mothers who smoke typically have lower birth weights (Kramer, 1987) they often go through a catch-up phase (Conter, Cortinovis, Rogari & Riva, 1995) which is associated with childhood obesity (Ong, Ahmed, Emmett, Preece & Dunger, 2000). Women who smoke are less likely to initiate breastfeeding and more likely to breastfeed for short durations (Burke et al., 2005; Ludvigsson & Ludvigsson, 2005).
- Socioeconomic class - The greater rate of breastfeeding among mothers of higher socioeconomic status may reflect an awareness of the risks of obesity and may make them less likely to overfeed children, regardless of the mode of feeding (Kramer et al., 2002). Wadsworth, Marshall, Hardy & Paul (1999) note that in Britain the reversal over several decades from highest to lowest rates of breastfeeding in the

lower socioeconomic class may be related to employment and the opportunity to choose not to breastfeed.

- Dietary factors
  - Breastfeeding may influence early food preferences because food flavors can enter both amniotic fluid and breast milk. This appears to have a positive effect on vegetable consumption, for example (Mennella, 2004).
  - There are significant differences among ethnic groups in infant feeding patterns, such as the use of formula, the solid foods which are offered, and the form in which they are offered (Li, Zhao, Mokdad & Grummer-Strawn, 2003).
- Physical activity –Dewey (2003) speculates that mothers who breastfeed have a healthier life style. Their dietary habits and levels of physical activity may be better and translate to the child.
- Birth weight – Babies with lower mean birth weight are more often formula fed and have an increased risk for later accumulation of fat in the abdominal area. The relationship between breastfeeding and risk for later obesity was significantly attenuated in studies which adjusted for birth weight and maternal factors (Owen et al., 2005).
- Other variables reflecting social, economic and lifestyle factors

Breastfeeding may be protective because of “physiologic factors in human milk or the feeding and parenting practices associated with nursing” (American Academy of Pediatrics, 2003, pg. 425). There are several possible explanations for breastfeeding reducing the risk of later obesity.

- *Behavioral mechanisms*
  - Breastfed infants may learn self-regulation of energy intake as they control feedings based on satiety cues, whereas bottle-fed babies may be encouraged to consume all of the formula in the bottle even if they are satisfied. Formula-fed infants gain more weight in the first few months of life than breastfed infants (Dewey, 1998). Rapid weight gain in the first 4 months of life has been associated with an increased risk of overweight status at age 7, independent of birth weight and weight attained at age 1 (Stettler, Zemel, Kumanyika & Stallings, 2002). In response to a high calorie preload, children who were breastfed were better able to adjust their intake (Birch & Fisher, 1998).
  - The natural regulation of intake by infants based on sensations of hunger and satiety may be overridden by restrictive and controlling feeding practices. In a large ethnically diverse sample, mothers who breastfed in early infancy and who breastfed for longer periods reported less restrictive child feeding at 1 year (Taveras et al., 2004). In a small sample of white mothers, those who breastfed for at least 12 months exercised less control

over feeding when their children were 18 months old than mothers who did not breastfeed that long (Fisher, Birch, Smiciklas-Wright & Picciano, 2000). Increased feeding restriction has been associated with later increased eating and weight status among children (Faith et al., 2001).

- *Hormonal mechanisms* - Leptin is a key regulator of appetite and is positively correlated with body fatness. Breastfeeding may affect leptin metabolism during infancy and later in life, either via direct exposure to leptin in human milk or indirectly via the effects of the rate of weight gain on leptin levels (Dewey, 2003).
- *Differences in macronutrient intake* - Breastfed babies more readily accept new foods than formula-fed babies, particularly vegetables, which reduces the energy density of their diet (Grummer-Strawn & Mei, 2004).
- *Lower protein intake* - A high protein intake at ages 1 to 2 years predicted an earlier adiposity rebound (Rolland-Cachera, Deheeger, Akrouf, & Bellisle, 1995). [See "Early Childhood" in the Critical Periods section for a discussion of adiposity rebound and its potential relation to later obesity.] Formula-fed babies consume 66-70% more protein than breastfed babies at 3-6 months (Heinig, Nommsen, Peerson, Lonnerdal & Dewey, 1993). Protein intake tends to stimulate high insulin secretion which may result in earlier fat deposition, but the subsequent effect is still under investigation (Dewey, 2003).

Data on the prevalence of breastfeeding in the United States was collected in the 2001 National Immunization Survey and summarized by Li et al. (2003, p. 1198). Similar figures have been reported by Briefel, Reidy, Karwe and Devaney (2004).

- Breastfeeding initiation at 65% is closer to the national goal of 75% than the continuation of breastfeeding at 6 months (28% vs. a goal of 50%) and at 12 months (12% vs. a goal of 25%) (Li et al., 2003).
- Only 17% of babies were exclusively breastfed beyond 4 months, with the proportion declining to 8% by 6 months.
- An average duration of 5.5 months for all who initiated breastfeeding was reported in a national random sample (Briefel et al., 2004)
- Non-Hispanic blacks had the lowest rate of breastfeeding initiation and continuation. The percentage of Hispanic and non-Hispanic White babies who were ever breastfed and who received any breastfeeding at 6 months were about equal.

Rates of initial and continuing breastfeeding by African American mothers are lower than national rates. In the large multiracial, multiethnic sample of low income families who used Public Health services, Grummer-Strawn & Mei (2004) observed that fewer than 30% of the children were ever breastfed, and only 6.1% were breastfed for more than 6 months.

In 1995 in the U.S., 43% of all teen mothers initiated breastfeeding in the hospital, and 21% were still breastfeeding at 6 months. Rates were lower among teen mothers in minority groups, particularly African American teens (Ryan, 1997).

“Education of both parents before and after delivery of the infant is an essential component of successful feeding” (American Academy of Pediatrics, 2005, pg. 498).

In a nationally representative sample of parents with children younger than 3 years of age (Lu et al., 2001, p. 290):

- 73.2% of women reported having been encouraged to breastfeed by their physician or by nurses.
- 74.6% of women who were encouraged to breastfeed – and 43.2% of those who were not encouraged -- initiated breastfeeding. Women who were encouraged to breastfeed were 4 times more likely to initiate breastfeeding.
- Provider encouragement resulted in a more-than-threefold increase in breastfeeding initiation among low-income, young, and less-educated women; by nearly fivefold among black women; and by nearly 11-fold among single women.

Issues related to breastfeeding raised by African American and Latina adolescents who were attending school during pregnancy and in the 3-month postpartum period reflect both the teens' stage of development and cultural influences (Hannon, Willis, Bishop-Townsend, Martinez & Scrimshaw, 2000).

- Teens with strong perceptions of benefits for their babies were most likely to express an intention to breastfeed. While some teens felt breastfeeding would result in a stronger bond with the baby and assure that they were identified by the baby as its mother, others were concerned that the baby would be too attached and would not easily adjust to anyone else feeding the baby. That concern led some mothers to choose formula feeding or early weaning.
- Problems which were perceived included pain, embarrassment about feeding in public, and the effects of certain food or emotions on the baby. When strategies were proposed to address these concerns, teens expressed greater interest in breastfeeding. Information about the use of the breast pump to facilitate continuation of breastfeeding while returning to school is needed.
- Teens were more likely to decide to breastfeed when someone had acknowledged and addressed their concerns. Attitudes of important people, particularly the teen's mother and partner, are important. Significant people, including teachers, could be allies in efforts to promote breastfeeding among minority adolescent mothers. Schools could provide information about breastfeeding to pregnant teens through nutrition classes, La Leche League feeding demonstrations and videos, and school health personnel.

Gross et al. (1998) found that WIC-based peer counseling and motivational videos resulted in a higher rate of initiation and a slower decline in rate of breastfeeding among African American mothers during the 16 weeks of the intervention. Mothers in the treatment group were twice as likely to be breastfeeding at 8 and at 16 weeks as those in the control group. Mothers who had previously breastfed were most responsive. Least responsive were

mothers younger than 19 years and older than 25, who had a male infant, and who were employed or in school at 8 weeks postpartum. There was no difference in breastfeeding behavior if mothers in the treatment group received only counseling or the motivational videos or both.

Interviews with an ethnically diverse sample of nearly 700 mothers 18 years of age or younger conducted within 48 hours of giving birth suggest that modeling and facilitation of breastfeeding are important strategies to promote breastfeeding among adolescents. Mothers who had considered breastfeeding but chose formula feeding were more likely to be impoverished, lack family support, perceive barriers to breastfeeding while attending school or working, had no prior experience attempting to breastfeed an older child, and had less encouragement to breastfeed than mothers who did not consider breastfeeding. They also made their feeding decision late in pregnancy and reported that at least two significant others had encouraged them to choose formula feeding. Wiemann, DuBois and Berenson (1998) point out that this is a subgroup which could be identified by nurses, lactation specialists or other health care workers during the last months of pregnancy and encouraged to breastfeed. "Educators should also be aware that many pregnant adolescents may respond to feeling empowered to make their infant-feeding decision alone, rather than relying on exhortations from authority figures or advice from significant others" (p. 868).

### **Introducing solid foods**

"There is no evidence for harm when safe, nutritious complementary foods are introduced after 4 months when the infant is developmentally ready. Similarly, very few studies show significant benefit for delaying complementary foods until 6 months" (American Academy of Pediatrics, 2004, p. 108). The Start Healthy Feeding Guidelines for Infants and Toddlers describe changes in physical skills, eating skills, baby's hunger and fullness cues, and appropriate foods and textures through seven stages of development from birth to 24 months (Butte et al., 2004).

Grummer-Strawn & Mei (2004) posit that breastfeeding may be insufficient to counter lifestyle issues, such as differences in the introduction of solid food and the use of formula by various ethnic groups (Li et al., 2003). Low-income mothers generally introduce solid foods earlier than recommended by physicians. Disregard of professional advice on this topic stems from cultural, family and peer pressure (Bentley, Gavin, Black & Teti, 1999).

Despite education provided by WIC about delaying the introduction of solid food until 4-6 months of age, in a sample of African-American WIC participants, Bronner et al., (1999) found that nonmilk liquids or solids were introduced

- to about 1/3 of infants by 7- 10 days postpartum (only 40% of the sample breastfed initially; only 20% continued into the 7-10 day period)
- to 77% of infants by 8 weeks
- to 93% of infants by 16 weeks

In order of likelihood of introducing solid food early were

- mothers who were both breastfeeding and formula feeding,

- then mothers who were formula feeding exclusively,
- and least likely were mothers who were breastfeeding exclusively.

In the 2002 Feeding Infants and Toddlers Study, a national random sample of 3,022 infants and toddlers age 4-24 months, Briefel et al. (2004) found that 2/3 of infants had been introduced to solid foods at 4-6 months as recommended by the American Academy of Pediatrics (1998 – updated in 2003). However, 17% consumed juice before the recommended 6 months or later, 22% of infants 9-11 months had consumed cow's milk on a daily basis before the recommended age of 12 months or later, and one in 10 consumed French fries and/or sweetened beverages on any given day. They also found that French fries became the most common vegetable consumed by 18-24 months.

Baughcum et al. (2001) did not find an association between overweight beyond infancy and (a) early introduction of solid food or (b) adding cereal to formula. The authors concluded that it is unclear if the introduction of solid foods earlier than recommended (American Academy of Pediatrics, 2003) increases the risk of childhood obesity.

- A prospective observational study found that introduction of solid food before 15 weeks increased fatness at 7 years (Wilson et al., 1998).
- The claim that early introduction of solids predicts childhood obesity was not supported in three observational studies following children beyond the first year of life (Agras, Kraemer, Berkowitz & Hammer, 1990; Kramer, Barr, Leduc, Boisjoly & Pless, 1985; Zive et al., 1992) and one randomized trial with outcomes measured at 12 months of age (Mehta, Specker, Bartholmey, Giddens & Ho, 1998). In the Avon longitudinal study, Reilly et al. (2005) found no effect of the timing of the introduction of solids related to risk of obesity at age 7.

### **Monitoring and controlling**

Costanzo and Woody's (1985) obesity proneness model proposed that excessive parental feeding control decreases a child's ability to self-regulate food intake according to the internal cues of hunger and satiety. Parents regulate food intake in children who appear to be susceptible to overweight in an effort to protect them from the consequences of the deviant status of obesity in the culture, which becomes more pronounced in adolescence and young adulthood and is stronger against girls. Having been denied the opportunity to develop self-control based on internal clues, these children respond to external clues and are more prone to excessive energy intake – and excessive weight gain.

When "restriction" is defined as not allowing a child access to food which has been brought into the home, the practice can increase preference for that food (Johnson & Birch, 1999) and promote intake of that food (Birch, 1998). Restriction may entail allowing a food to be eaten in only limited quantities, only after other foods have been eaten, or only for special occasions. Parents may restrict access to specific foods to reduce intake of the food or induce a dislike for the food.

Control may also be exerted by promoting specific foods (Birch, 1998). Parental controlling behavior has been associated with lower consumption of fruit, juice and vegetables (Cullen et al., 2000).

Some researchers support the notion that parental (primarily maternal) restriction reduces children's ability to self-regulate food intake (Birch & Fisher, 1998; Spruijt-Metz, Lindquist, Birch, Fisher & Goran, 2002; Satter, 1996). In middle-class white families, maternal control of eating has been associated with

- girls 5 and 7 years of age eating in the absence of hunger (Birch, Fisher & Davison, 2003; Fisher & Birch, 2002)
- higher energy intake and body mass in daughters (Birch & Fisher, 2000; Lee, Mitchell, Smiciklas-Wright & Birch, 2001)
- inability to self-regulate food intake in preschool children (Johnson & Birch, 1994) and in pre-adolescents (Edmund & Hill, 1999)

In a review of 22 studies which tested the associations between parental feeding styles and child eating and weight status, "most studies that explicitly assessed maternal feeding restriction . . . found significant associations with child eating and weight" (Faith, Scanlon, Birch, Francis & Sherry, 2004, p. 1719). The reviewers call for additional research to determine the "appropriate" level of parental control to shape children's diets within recommended guidelines while avoiding creation of preferences for unhealthy foods and compromising children's ability to self-regulate by focusing on external cues to hunger and satiety. These study samples varied from one to four racial/ethnic groups; two studies also included an "other" category.

Baughcum et al. (2001) "hypothesize that an overweight child's appetite 'dysregulation' may reflect an inherited susceptibility to obesity and that parental restriction is a response to the child's overeating rather than the cause of the overeating. . . . Whether parents decide to restrict or structure their child's eating, in the face of an obesity-promoting environment, may be an indicator of parenting style. These styles may differ by income" (p. 7). The authors note the similarity of findings with those of qualitative studies which report low-income mothers' difficulty setting limits (i.e., feeding a child who claims to be hungry right after a meal) (Jain et al., 2001), but it is not possible to predict if restriction of children's eating would affect outcome.

Boys appear to be better self-regulators than girls (Birch, 1998). Pomerantz and Ruble (1998) note that, although they do not report differing levels, parents grant more autonomy to boys on many issues. If this applies to eating, more autonomy for boys may make the food appear less forbidden and inviting (Costanzo & Woody, 1985). Girls' overconsumption of restricted food (Fisher & Birch, 1999a) is similar to that observed in studies of adults who impose dietary intake restrictions on themselves (Heatherton, Polivy & Herman, 1990; Tuschl, 1990).

Restrictions may also result in girls feeling that they are "bad" when they consume a forbidden food because they evaluate their performance based on the expectation of an

important adult, usually a parent (Burhans & Dweck, 1995). Restrictions placed on girls may reflect societal values of thinness as a factor in attractiveness for women.

Independent of income or the child's weight status, obese mothers (Baughcum et al., 2001).

- reported greater concern about their child overeating and being overweight than non-obese mothers, similar to Baughcum et al. (2000),
- engaged in more age-inappropriate feeding, and
- had a tendency to give their children less control in the feeding context (e.g. not letting their child choose food from what is served).

Maternal weight status has been positively correlated with maternal control over feeding (Fisher & Birch, 2002; Saelens et al., 2000).

- Parents' own restricted eating style predicted maternal restriction of access to snacks for girls but not for boys; girls accurately perceived maternal restriction levels; and greater amounts of snacks were consumed by girls, but not by boys, 3-5 years of age when given uncontrolled access to them (Fisher & Birch, 1999b).
- In 5- to 8-year old children in Australia, mothers who were restraining their own diets exerted more control over their daughter's eating habits than their sons' eating habits, regardless of the weight status of the children (Tiggeman & Lowes, 2002).

Similar to Baughcum et al. (2001), Faith et al. (2004) note that "feeding styles might influence child weight, child weight might influence feeding style or both." (p. e433). From their study of parental feeding attitudes at ages 5 and 7, the authors concluded that the relationship between parental feeding patterns and children's BMI depends on "child obesity predisposition, suggesting a gene-environment interaction. Among children predisposed to obesity, elevated child weight appears to elicit restrictive feeding practices, which in turn may produce additional weight gain. Parenting guidelines for overweight prevention may benefit from consideration of child characteristics such as vulnerability to obesity and current weight status" (p. e429).

There is significant support for a bi-directional association (Birch & Fisher, 2000; Costanzo & Woody, 1985; Davison & Birch, 2001; Johnson & Birch, 1994). Both in cross sectional and prospective data, Faith et al. (2004) found parental concern about child weight associated only with high-risk children. Parental response to child weight was also evident in families pre-disposed to thinness, with parents more likely monitoring fat intake to encourage children to eat more.

Findings in two studies which did not conclude that parental dietary restriction negates self-regulation may be related to the age of the children.

- In the analysis of data from a large multiethnic sample of third graders, Robinson, Kiernan, Matheson and Haydel (2001) found no differences related to socioeconomic status. The researchers note that parents may have more control over 3-5 year olds (Johnson & Birch, 1999) than 8-9 year olds, who are also influenced by peers, mass media, and the school environment.

- A study involving families with one obese and one non-obese sibling 7-12 years old did not substantiate the claim. Although levels of maternal restrictions varied *between* families, restrictions *within* families were very similar, despite significant weight differences between siblings (Saelens, Ernst, & Epstein, 2000).

Although high levels of parental control in feeding practices have been associated with children having difficulty self-regulating energy intake and thereby increasing the risk of obesity, most of these studies were conducted with white, well-educated parents (e.g., Birch et al., 1998; Johnson & Birch, 1993). Studies examining feeding patterns for infants and preschoolers in ethnically diverse samples left the question of direction of effect unresolved (Baughcum et al., 2001).

### Feeding practices of African-American, Hispanic and Mexican-American parents

The Child Feeding Questionnaire (CFQ), which measures parental attitudes, beliefs and practices about child feeding and proneness to obesity, was developed by Birch et al. (2001) with White and Hispanic samples and has been used with middle class European Americans. When the CFQ was tested in a sample of 101 Black and 130 Hispanic low-income parents of pre-school children, important differences were found (Anderson, Hughes, Fisher & Nicklas, 2005). While Birch et al. (2001) found a moderate correlation between restriction of food and concern about weight among White parents, Anderson et al. (2005) found high mean ratings for restriction but low concern about weight among African-American parents, suggesting that restriction was undertaken for reasons such as children not eating well at the next meal, rather than concern about weight. It is important to note that this study did not measure child eating, which is the "primary mediator of parental attitudes/practices and child weight relationship" (p. 529).

In the total sample, 78% of parents of overweight or at risk children regarded the child as average or underweight. African-American parents underestimated the weight of their child to a greater degree than Hispanic parents and did not differ in that perception by level of education. Although all African-American parents exhibited a low level of concern about their child's weight, the level of concern was markedly low among less educated parents. Hispanic parents with more education were less likely to classify overweight children as normal or underweight, but there were no differences by education level in concern about the child's weight (Anderson et al., 2005). The researchers recommended some modifications to the CFQ for use among these minority subgroups.

Seeking to tease apart the processes that underlie the influence of parenting feeding style on children's eating, Hughes, Power, Fisher, Mueller and Nicklas (2005) developed the Caregiver's Feeding Styles Questionnaire (CFSQ) to study the feeding styles of ethnically diverse parents. Parents using an authoritative feeding style reason with children to achieve compliance with desired dietary habits and allow them to choose among appropriate foods, whereas parents using an authoritarian style may physically struggle with their children to get them to eat or show disapproval when children do not eat. An authoritative parenting style is child-centered; an authoritarian style is parent-centered.

In the same sample of African-American and Hispanic parents studied by Anderson et al. (2005), Hughes et al. (2005) found that parents of children with the lowest BMI s reported using an authoritarian feeding style. This finding may be a result of parents having control of the food resources and access to those resources (Hughes - personal correspondence, 2005).

*Demandingness* refers to the extent to which parents show control, maturity demands, and supervision in their parenting; in the feeding domain, this refers to *how much* the parent encourages eating. *Responsiveness* refers to the extent to which parents show affective warmth, acceptance, and involvement; in the feeding domain, this refers to *how* the parent encourages eating. The authors note that the significant cultural differences apparent in the use of indulgent and uninvolved feeding styles should be heeded in developing interventions (Hughes et al., 2005).

FEEDING STYLE	% OF ALL PARENTS	% USING THIS STYLE BY GROUP	CHILDREN'S BMI z SCORES
<i>Authoritarian</i> - high demandingness and low responsiveness	36	African-American - 41.7% Hispanic - 58.3%	0.52
<i>Authoritative</i> - high demandingness and high responsiveness (uses discussion, negotiations and reasoning; provides rationales; and praises the child)	15	African-American - 41.2% Hispanic 58.8%	0.72
<i>Indulgent</i> - low demandingness and high responsiveness (less controlling and more child-centered feeding behaviors)	35	African-American - 37.5% Hispanic - 62.5%	1.01
<i>Uninvolved</i> - low demandingness and low responsiveness (neither controlling nor child-centered)	14	African-American - 66.7% Hispanic - 33.3%	0.62

Although children whose parents used an authoritarian feeding style had the lowest BMI s, Patrick, Nicklas, Hughes and Morales (2005) found in this same group that “Parents who are more authoritative with regard to feeding seem to be promoting more healthful eating patterns in their children. Authoritative feeding may be part of a broader model of optimal feeding styles involving such things as feeding behaviors, emotional climate of mealtimes, and meal structure” (p. 248). “Authoritative feeding was positively associated with availability of fruit and vegetables; attempts to get the child to consume dairy, fruit, and vegetables; and child’s consumption of dairy and vegetables. In contrast, authoritarian feeding was negatively associated with the availability of fruit and vegetables, and with child’s consumption of vegetables” (Patrick et al. 2005, p. 247).

Kaiser et al. (2001) found that feeding practices vary among Mexican American mothers of preschool children, depending to some degree on the level of acculturation. Less

acculturated mothers tend to offer alternative foods more often when their children refuse to eat. More acculturated mothers were less likely to use bribes, threats or punishment as strategies to encourage eating. According to parental reports, child-led snacking was very high in both groups and did not seem to be associated by mothers with poor appetite at meals or overweight.

In a low-income Latina population with children 5-8 years of age, mothers' cognitive restraint on their own eating was associated with providing a more healthful diet for their children. Although there was a low correlation between mothers' cognitive restraint and mothers' weight, practicing cognitive restraint was not related to the children's weight (Contento, Zybert & Williams, 2005).

### **Modeling and family meals**

Parents can encourage children to eat healthful food by modeling behavior associated with healthy eating and not restricting intake (Fisher & Birch, 1999b). Children are more likely to try a new food if they have seen an adult, particularly their mother, eating it (Harper & Sanders, 1975).

Tibbs et al. (2001) suggest that parent modeling may be particularly significant in African American families because it builds on the strength of the family and kinship networks. In this study, parents were selective in the behaviors they modeled. They more frequently sat with their children at meals and ate foods they wanted their children to eat but were less likely to model intake of low-fat snacks and vegetables. Parents who have a laissez-faire approach to child feeding or are not concerned about particular dietary habits may be less likely to set dietary rules for children or model healthy dietary behaviors (Tibbs et al., 2001).

In a small qualitative study with ethnically diverse parents of children in Head Start, parents reported that meal and snack times were often unpleasant because they did not know how to deal with demanding children and thus served only what children wanted and did not offer new foods; children's eating behaviors were out of control; and meals were generally unplanned and unstructured. Suggestions about offering choices of healthy foods from which children can choose may help to "improve parental self-efficacy for practicing mealtime responsibilities" (Hoerr, Utech & Ruth, 2005, p. 185). Helping parents plan and structure mealtime and snack time might reduce the conflict which negatively affected parental self-efficacy.

Family meals provide a venue for parental modeling and improving the dietary intake of children and adolescents. Parental and 5-year-old daughters' intake of fruits and vegetables has been found to be positively related. However, when parents who eat few fruits and vegetables pressured daughters to eat them, daughters consumed fewer vegetables and fruits (Fisher, Mitchell, Smiciklas-Wright & Birch, 2002). Children eat fewer fruits and vegetables when family meals do not occur (American Academy of Pediatrics, 2003).

In a sample of almost 5,000 ethnically diverse middle and high school students, 1/3 reported eating with their family two or fewer times per week, and 14% reported no family meals during the week prior to the survey. The frequency of family meals declined as students moved from middle to high school. Mothers' employment was inversely related to the frequency of family meals. Family meals were reported more frequently among Asian American students (primarily recent Hmong immigrants) than in other ethnic groups and among youth of higher socioeconomic status. However, there were large differences within subgroups. Frequency of family meals was highly positively correlated with the intake of recommended nutrients for proper growth and was negatively correlated with soft drink consumption (Neumark-Sztainer, Hannan, Story, Croll & Perry, 2003).

Similarly, analysis of the National Longitudinal Study of Adolescent Health based on more than 18,000 adolescents demonstrates that family meals are positively associated with adolescents' higher consumption of fruits, vegetables and dairy products. Consumption patterns differed significantly by ethnic group and were higher for adolescents of parents with higher levels of education. The presence of at least one parent during the evening meal was the most significant parent behavior related to adolescent eating habits. Given the large effect found in this analysis and the fact "that one of every three adolescents reported eating three or fewer meals with their parent(s), family meals constitute a prevalent risk factor for poor food intake" (Videon & Manning, 2003, p. 370).

When given autonomy in food selection, 25% of adolescents skipped breakfast. Adolescents who ate more evening meals with parents were more likely to eat breakfast. Promoting breakfast is a promising approach to improving adolescent nutrition (Videon & Manning, 2003).

In preschool children in Spain, Ortega et al. (1998) found that children who had inadequate breakfasts had diets with the worse energy profiles and high fat intake. An inadequate breakfast was defined as one supplying less than 20% of daily nutrient requirements.

Family meals also play a significant role in preventing unhealthy weight control practices among adolescents (Neumark-Sztainer, Wall, Story & Fulkerson, 2004). The researchers suggest that parents make a concerted effort to increase the frequency of family meals and make them pleasant experiences.

### **Rewarding**

Limiting access to sweet and high-fat foods which were used as rewards has been found to establish a preference for the reward food (Birch, Zimmerman & Hind, 1980). Rewarding children for trying a food results in a decreased preference for that target food over time (Birch, Marlin & Rotter, 1984). Mothers who used food as a reward were not particularly obese in the Baughcum et al. (2001) study.

## CHILD EATING HABITS

### Food preferences

“... because food preferences are learned, they are modifiable, although the data suggest that the best chance for fostering patterns of preference consistent with healthier diets may be to focus on the very young” (Birch, 1999, p. 57).

Although parents determine what foods are available through their choices in purchasing and serving foods, children's preferences are important determinants of what they actually eat (Birch, 1999). Children's eating preferences develop in the context of palatable food, social setting, emotional states, attitudes, knowledge and beliefs about nutrition, food and eating (Birch, 1998; Birch et al., 1980).

“By the time children are 3 or 4 years old, eating is no longer deprivation-driven but is influenced by their responsiveness to environmental cues about food intake” (Patrick & Nicklas, 2005, p. 83).

There is evidence that the first exposure to taste occurs in the uterus and depends upon the mother's diet (Mennella, Johnson & Beauchamp, 1995). Breastfed babies appear to be exposed to more diverse tastes than are formula fed babies (Mennella & Beauchamp, 1991).

Humans are born with a preference for sweet taste (Beauchamp & Moran, 1982). Preference for sweet taste remains through childhood, declines somewhat during late adolescence, and is usually established at a moderate level during adulthood (Desor & Beauchamp, 1987; Zandstra & De Graaf, 1998). Preference for sweetness is positively related to consumption of sweet foods by children (Olson & Gemmill, 1981). Children who had greater restriction on sugar intake demonstrated a greater preference for sweetness in drinks than children who had less restriction, the opposite outcome desired by parents (Liem, Mars & DeGraaf, 2004).

“Preferences for sweet taste, probably for salty taste, and the rejection of sour and bitter tastes are innate and unlearned” (Birch, 1998, citing Beauchamp et al., 1994). Other food preferences are learned from early experience and are associated with social contexts of eating and with physiological consequences (Birch, 1998). Children may develop a preference for energy dense foods when their flavors are associated with positive physiologic effects like satiety. A preference for energy dense foods is obviously good in times of scarcity but appears to be harmful in times of plenty (Birch, 1998).

“Offering children a nutritionally adequate diet is necessary but may not be sufficient to ensure dietary quality; children's food preferences are influential determinants of macronutrient intake” (Fisher & Birch, 1995, pg. 759).

Children as young as two years of age have demonstrated a preference for foods that their mothers like (Skinner, Carruth, Bounds, & Ziegler, 2002). Parents' beliefs about the value of various foods help to shape children's dietary intake (Dennison, Erb, & Jenkins, 2001).

However, when given the opportunity to select their foods, preschool-age children do not make choices which result in a nutritious diet (Klesges, Stein, Eck, Isbell & Klesges, 1991). A small study of 5 years olds demonstrated that children will choose less nutritious foods when given an opportunity but choose foods lower in sugar when they know that their mothers will be monitoring what they eat. When parents made the choices, foods selected had more nutrient value but were not those rated with the highest nutrient value. No differences were seen that were related to the obesity of either the parent or the child.

In an analysis of data from the 1994-1996, 1998 Continuing Survey of Food Intake by Individuals, children at age 5 were found to have a greater mean intake of fruit drinks and ades and carbonated soda than 100% fruit juice. By age 13, children were consuming more carbonated soda than milk, 100% fruit juice, or fruit drinks and ades (Rampersaud, Bailey & Kauwell, 2003). A 6-oz. glass of 100% fruit juice is considered to be one fruit serving for most children and adolescents.

Availability of sweet drinks for preschool children was found to be significantly related to overweight. In a retrospective cohort study with more than 10,000 children 2 and 3 years of age in the WIC program in Missouri, consumption of sweet drinks was associated with increased risk of overweight for both children at risk (>85<sup>th</sup> - <95<sup>th</sup> percentile of BMI) and for overweight children (>95<sup>th</sup> percentile). The association between sweet drink consumption and development of overweight was positive but not statistically significant for normal-weight children (Welsh et al., 2005). Consumption of fruit juice was not related to overweight for either children of normal-weight or at-risk for overweight. The findings were independent of gender and ethnicity but did not account for parental obesity, television viewing or formula feeding. The mechanism by which sweet drink consumption contributes to overweight is not clearly understood.

In a WIC study in North Dakota with 1,345 children aged 2 to 5 years, an association between beverage consumption and changes in weight or BMI was not found (Newby et al., 2004). This study is similar to Welsh et al. (2005) regarding the lack of association with juice but differs regarding soda and fruit drinks.

In a randomized cluster study with 7-11 year olds in England, promoting drinking water as part a healthy diet intervention, tasting fruit to learn about natural sweetness, and writing a song with a healthy message demonstrated 0.2% reduction in obesity in the intervention group compared to a 7.2% increase in the control group at the 12-month follow-up. Consumption of carbonated beverages declined by .6 glasses in the intervention group but increased by .2 glasses in the control group (James, Thomas, Cavan & Kerr, 2004).

Fisher and Birch (1995) found that 3- to 5-year-old children's preference for high-fat foods was positively related to their level of overweight and to their parents' adiposity. When given choices, children with a preference for high-fat foods consumed a greater proportion of their daily energy intake in fat, sometimes as much as 41% at an age when the USDA recommended ratio is 30%. These same relationships were also found in 9- and 11-year-old boys and girls (Gazzaniga & Burns, 1993).

Schonfeld-Warden and Warden (1997) reported that children whose parents were educated about fat-prudent diets were less likely to be obese at age 3 than similar children in the control group. The Framingham Children's Study demonstrated that the nutrient quality of preschool children's diets is highly influenced by their parents' eating patterns (Oliveria et al., 1992).

Children tend to have a limited variety of preferred foods that are consumed repeatedly (Simons-Morton et al., 1990). Because of these habits, the fat content of preferred foods is an important factor in the overall energy intake of most children's diets. Children generally do not eat foods that they do not like (Birch & Fisher, 1998).

Children tend to prefer the foods that are served most often and to prefer foods that are available at home (Birch & Marlin, 1982). Children and adolescents demonstrate a preference for healthier foods when they are readily available at home (Baranowski, Cullen & Baranowski, 1999; Story, Neumark-Sztainer & French, 2002). Consumption of fruits and vegetables among school children increases if they are prepared and cut into bite-size pieces (Baranowski et al., 1999).

Neophobia, the avoidance of new foods, appears to be minimal in infancy, increases sharply about the age of 2 and then declines thereafter (Cashdan, 1994). Reluctance to try new foods may be an evolutionary adaptation from a time when consuming any available plant life could have deleterious effects. This trait may still serve a protective factor during early childhood when children have more opportunities to decide what to put in their mouths and are thus more vulnerable to accidental poisonings (Cashdan, 1998). However, it may also account for why children are less likely to try vegetables, fruits to some degree, and meat and eggs to a lesser degree.

Among children 5-11 years of age, Pliner and Loewen (1997) found shyness and emotionality to be related to food neophobia. The relationship was both observed when children were confronted with novel foods and reported by mothers as typical behavior. Children with this kind of temperament may be reacting to unfamiliar foods as they would to any feature in their environment which is new and unknown.

Children who are neophobic have been found to eat fewer fruits and vegetables (Cooke et al., 2004). A study with children 2-6 years of age and their parents suggests that parents with neophobic children use more control in an effort to get them to eat healthful foods (i.e., neophobia causes parents to exercise control), but the study was cross-sectional and cannot rule out the possibility that parental control causes children to be neophobic (Wardle, 2004).

In a randomized trial of parent-led exposure, children 2-6 years old whose parents encouraged them each day for 14 days to taste a vegetable previously not liked increased their consumption of that vegetable more than children whose parents received either information about the benefits of eating more vegetables or children whose parents were in the control group (Wardle et al., 2003). To encourage tasting, parents might say "Now, I've done it, can you do it too?" or "You don't have to eat it, just taste it." Parents were

instructed not to provide rewards for consumption. In random follow-up interviews 6 weeks after the end of the intervention, 7 out of 10 parents in the exposure group reported that their children continued to like the vegetable. Some parents reported an increased willingness for children to try new foods. However, failure by some families to complete the 14-day cycle suggested that the intervention period may have been too long.

In a prospective study conducted initially between 1982 and 1999, Nicklaus, Boggio, Chabanet and Issanchou (2005) recorded food choices made by children 2 to 3 years of age in a French nursery canteen and developed "food variety seeking scores" by food groups: vegetables, animal products, dairy products, starchy foods and combined dishes. In 2001 and 2002, food variety seeking behavior was again assessed among 339 of these subjects, who at the follow-up were in several age groups: 17-22, 13-16, 8-12, and 4-7. Variety seeking modestly increased with age between 4 and 22, was strong for dairy products and for vegetables, and somewhat weaker for animal products. There was a "a negative relationship between variety seeking at follow-up (globally and for each food group) and neophobia, and between neophobia and early variety seeking" (p. 294). Early exposure to a variety of foods appears to play a significant role in later food preferences.

In a random sample of 3,022 infants and toddlers, Carruth, Ziegler, Gordon & Barr (2004) found that the prevalence of picky eaters identified by caregivers was similar across genders, ethnicities, and income levels. However, the percentage identified as picky eaters increased from 19% at 4 months to 50% at 24 months. Because "picky eater" was not defined by the telephone surveyors, caregivers were reporting their perceptions of picking eating. Analysis of one-day recall data provided by caregivers showed that both picky and non-picky eaters "met or exceeded current age-appropriate energy and dietary recommendations" (pg. 557). The number of times new foods were offered to picky and non-picky eaters was similar, ranging from 1-2 times to 6-10 times, with 3-5 times most frequently reported.

Carruth et al. (2004) recommend increasing that number, noting that 8-15 repeated exposures may be necessary for acceptance of a new food. Sullivan and Birch (1990) have suggested that new foods may need to be offered as many as 10 times. Cooke, Wardle & Gibson (2003) recommend regular and repeated exposures with vegetables, fruit, meat and eggs during the preschool years.

There is some evidence that breastfed babies are more accepting of new foods (Birch & Marlin, 1982; Sullivan & Birch, 1984). Breastfed babies preferred cereal mixed with mother's milk to cereal mixed with water (Mennella & Beauchamp, 1997).

Children as young as 2 years of age learn food preferences from their peer group (Birch, 1999). In a series of studies with small groups of preschool children, Hendy & Raudenbush (2000) found that *silent* modeling of eating new foods by the teacher did not result in children's willingness to try them. *Enthusiastic* teacher modeling ("I love mangos!" and eating several bites of the food) was more effective in promoting children's tasting new foods. Although some research shows that children need repeated exposures to new foods, positive response from children was greater at the first meal and declined during the next

four meals, suggesting a “novelty response.” However, when a trained peer expressed enthusiasm for a different new food at the same table at which a teacher practiced enthusiastic modeling, the effect of teacher modeling disappeared. While there was no gender difference in response to enthusiastic teacher modeling, girls were more responsive to peer modeling than boys.

During an intervention using peer modeling in primary schools (children age 4-11), children expressed a greater liking for, and increased their consumption of, fruits and vegetables (Lowe, Horne, Tapper, Bowdery & Egerton, 2004). For 16 days, children watched video adventures featuring heroic peers who enjoy eating fruit and vegetables, and children received small rewards for eating these foods. Consumption was higher at both lunchtime and at snack time than at baseline. The largest increases were seen in children who ate the least at baseline. During the intervention, consumption of fruits and vegetables outside school was higher on weekdays and weekends. Although the authors note that there was an increase in children reporting liking a range of fruit and vegetables, no information is provided about the way this data was gathered.

Nicklas et al. (2001) note the sparseness of data concerning how parents and child care providers influence children's eating habits. “Much of the previous work reported inconsistent findings and poorly understood mechanisms of influence. Influences on fruit, juice, and vegetable consumption may vary by ethnicity, age, socioeconomic status, and food group” (p. 230). Significant changes in family structure and relationships in the last quarter century (1975-2000) may make what was said about families and dietary behaviors in the past untrue in current conditions.

### **Self-regulation**

“The second year of life is a critical period for the development of food intake patterns that affect energy intake regulation” (McConahy, Smicklas-Wright, Birch, Mitchell & Picciano, 2002, pg. 340).

Children 12-18 months of age have been found to regulate their energy intake primarily by the size of portions they eat rather than by the number of times they eat (McConahy et al., 2002). Children who had fewer meals and snacks but ate larger portions of some foods were in racial/ethnic groups which have higher rates of obesity in older children and adults.

- Black children had fewer eating occasions and larger portions, but energy intake and body weight was the same as white children.
- Hispanic children had the greatest number of eating occasions, numbers of foods, and the greatest body weights, but energy intakes were lower.
- Children in low-income families had larger portions and greater energy intake but had fewer eating opportunities and fewer different foods.

These feeding patterns may reflect food insecurity in families with limited resources, although acculturation and English language proficiency also play a role in food insecurity (Kaiser et al., 2002). “While it is unclear whether or not food insecurity causes obesity,

there is an association between limited income, food insecurity, and the appearance of obesity in children and mothers in these households" (Sigman-Grant, 2003, p. 12).

McConahy et al. (2002) posit that eating fewer meals and larger portions may set up a pattern of eating larger portions that contributes to later obesity. In low-income families, a recurring cycle in which there is adequate and nutritious food at the beginning of a month but a dependence on energy dense, unhealthful food by the end of the month may set in motion biological responses that negatively affect future weight gain (Sigman-Grant, 2003). In families experiencing food insecurity, parents may limit their own intake to prevent children from being hungry (Kaiser et al., 2002; Sigman-Grant, 2003).

Some studies have also shown that very young children have the capacity to self-regulate energy intake over a 24-hour period by adjusting food intake (Birch, Johnson, Andersen, Peters & Schulte, 1991; Johnson & Birch, 1994). Mrdjenovic and Levitsky (2005) question these findings because the studies were conducted in laboratory settings. Dietary intake for 16 preschool children was measured in a child care setting (2 snacks and lunch) and at home for 5-7 consecutive days. The researchers found no evidence of energy intake regulation by the children at a meal or within 24 hours. "Instead, the major determinant of energy intake in children appears to be the amount served to them by their caregivers" (p. 280). Children did not reduce or increase the amount of food they ate at a meal or snack based on the previous meal, and they did not reduce their energy intake as the energy density of the food increased. The authors concluded that the environment is a more influential factor for children's food intake than the amount of food previously eaten or the composition of the current or previous meal.

When preschool age children were served portions double their age-appropriate size, they consumed 25% more of the entrée and increased their energy intake by 15% compared to when they were served age-appropriate portions. However, when children were permitted to serve themselves, they consumed 25% less of the entrée than when they were served a large portion (Fisher, Rolls & Birch, 2003).

Children who have difficulty sensing fullness appear to be most affected by oversized portions (Fisher et al., 2003). There is a significant lack of agreement on age-appropriate portion sizes in published child-feeding guidelines "with up to 4-fold differences in the recommended size of portions of the same foods" (McConahy et al., 2002, pg. 340). McConahy et al. (2002) recommend a daily pattern of three meals with smaller portions and three snacks which are high in nutrients that are often missing in children's diets, such as fortified cereal, lean meats, and dairy foods.

### **Consumption of fast foods**

Although French, Story, Neumark-Sztainer, Fulkerson and Hannan (2001) found a positive association between frequent consumption of fast food and television viewing, there was no association with obesity. In this survey of 7-12 graders in 31 schools, boys who ate fast foods 3 or more times a week had lower BMIs than boys who ate fast food fewer than 3 times a week. There was no difference for females related to the frequency of fast food.

The researchers speculate about future weight gain given the energy density of many fast foods and its association with soft drink consumption. Fast food consumption was also positively related to home availability of unhealthy foods and an inverse relationship with students' own and perceived maternal and peer concerns about healthy eating.

According to data from 6,212 children and adolescents in the Continuing Survey of Food Intake by Individuals (1994-1996), 30% consumed fast food on a typical day. There was significant consumption among both genders, all racial/ethnic groups, and all regions of the country. When SES and demographic variables were controlled, "increased fast-food consumption was independently associated with male gender, older age, higher household incomes, non-Hispanic black race/ethnicity, and residing in the South" (Bowman et al., 2004, p. 112). On days when they ate fast foods, children had a poorer diet and consumed more fat than when they didn't eat fast foods.

## ENERGY OUTPUT

Ironically, as access to relatively inexpensive foods has increased, "we have nearly eliminated the single largest source of physical activity (energy expenditure involved in moving our bodies) from our traditional human existence --walking" (Peters, 2004, p. 113). For example, most children ride a bus to school.

Some researchers feel that an increase in physical activity may be sufficient to prevent childhood obesity (Sothorn, 2004). However, after reviewing prevention trials published since 2000 (6 with adults, 11 with children), Wareham, van Sluijs & Ekelund (2005) concluded that there is insufficient evidence to suggest that increasing physical activity will be effective in preventing obesity.

Slyper (2004) notes that some longitudinal studies show that physical inactivity may be the result of obesity rather than its cause" (p. 2540). Based on obese children's physical activity preferences before and after successful weight loss, Ball, Crawford and Owen (2000) suggest that preferences for passive over active forms of entertainment may be a consequence rather than a cause of obesity.

Among overweight Pima Indian children, the level of physical activity declined between the ages of 5 and 10. Weight at both ages was associated with decreased participation in sports and increased television viewing. Although at 5 there was a positive correlation between weight and activity energy expenditure (AEE) and physical activity level (PAL), by 10 years of age there was no correlation between weight and AEE and a negative correlation with PAL (Salbe et al., 2002).

While some researchers have suggested that differences in resting energy expenditure between blacks and whites may account for increased overweight in African American children (Morrison, Alfaro, Khoury, Thornton & Daniels, 1996), other researchers disagree (Sun et al., 1998). From a longitudinal study of the influence of energy expenditure on

weight gain in children 4.6 to 11 years of age, Johnson et al. (2000) concluded that aerobic fitness may be more important than absolute energy expenditure in weight status in white and black children. The main predictor of increasing adiposity was the level of adiposity at baseline.

Slyper (2004) notes that in longitudinal studies there has been a stronger relationship between weight gain and sedentary activities such as television viewing or playing video games than self-reported measures of physical activity (Crespo et al., 2001; Hernandez et al., 1999). Self-reports of physical activity may be inaccurate. Another explanation is that increased eating is a more important factor than decreased physical activity.

Most interactions have focused on both eating and physical activity behaviors. Several long-term studies targeting both behaviors showed no differences in BMI between the treatment and control groups.

- In a 2-year intervention with third and fourth graders, Donnelly et al. (1996) found no weight differences as a result of increased physical activity and nutrition education.
- Although there were positive changes regarding eating and physical activity in elementary schools in the treatment mode, there were no differences in BMI between the treatment and control groups at the end of one year. Children did report a slight increase in the consumption of fruits and vegetables. While there was a negative trend of sedentary behavior increasing by one-third in the overweight children in the treatment group versus the control group, there were small increases in global self-esteem in the intervention schools among obese children (Sahota et al., 2001).

Several interventions targeting both behaviors have produced desired results:

- The Hip-Hop to Health Jr. program for preschool African American and Latino children demonstrated success in reducing excessive weight gain in children at both Year 1 and Year 2 follow-ups by involving children in nutrition lessons and 40-minute exercise sessions 3 times a week for 14 weeks (Fitzgibbon et al., 2005). [This efficacy trial is described in greater detail in the Intervention Section- Early Childhood.]
- Reduction in BMI and increased physical activity were positive outcomes for boys, but not girls, in a randomized controlled trial in middle schools. The intervention increased physical activity and reduced dietary fat intake while in school. During the 2-year intervention, boys' BMI at the control schools increased (Sallis et al., (2003).
- In an intervention with an ethnically diverse sample of tenth graders, students in the treatment group received nutrition education and increased their physical activity level. At the end of two months, several measures of adiposity, including BMI, were better for students in the treatment group than for students in the control group (Killen et al., 1988).

- An intervention with children 5-7 years of age and their parents produced positive changes for both normal weight and overweight children in the treatment group. Because Muller et al. (2001) believe that a low level of physical activity is a more significant factor in childhood obesity than diet, the intervention engaged overweight children and their parents in a structured sports program. However, all children received nutrition education and encouragement to reduce TV time as well as increased physical activity.
- Revision of physical education programs to include dancing (Flores, 1995) and endurance training (Dwyer, Coonan, Leitch, Hetzell & Baghurst, 1983) have resulted in reductions in weight and fat gain.
- A computer-based interactive multimedia intervention in elementary schools involving a game based on social cognitive theory and supplemented by four classroom and four homework assignments resulted in obesity reduction for girls but not for boys. There were subtle changes in physical activity level for girls and general improvement in psychosocial outcomes related to physical activity (Goran & Reynolds, 2005).

[Interventions which reduced television viewing time and increased physical activity are reported in the next section on Media.]

Pate et al. (2004) found that the program in preschools was a significant predictor of the level of physical activity in which a child engaged. Overall, boys engaged in more moderate-to-vigorous and vigorous physical activity than girls; black children engaged in more moderate-to-vigorous activity than white children. The latter finding is not consistent with other studies which have found black children in preschool to be less active than their white peers (Baranowski, Thompson, DuRant, Baranowski & Puhl, 1993; McKenzie, Sallis, Nader, Broyles & Nelson, 1992).

The amount of physical activity measured during the preschool day, on average, varied from 4.4 to 10.2 minutes per hour across the nine participating preschools. Guidelines suggest that children of preschool age should engage in 120 minutes of physical activity each day, divided evenly between structured physical activity and unstructured free play (National Association for Sport and Physical Education, 2002). A greater amount of variance in activity levels was accounted for by the preschools than by the children's demographic characteristics. This study indicates that policies regarding physical activity during preschool may result in significant differences in daily energy expenditure.

In the Framingham Children's Study, low levels of activity among preschool children had a moderately strong effect of increasing adiposity levels from preschool to first grade, but the risk of increasing body fatness related to low activity levels was lower for the leaner children (Moore, Nguyen, Rothman, Cupples & Ellison, 1995). Preschool children of an obese parent engage in less physical activity (Klesges, Eck, Hanson, Haddock, & Klesges, 1990; Sallis, Patterson, McKenzie & Nader, 1988). When both parents are obese, the activity level

is further reduced (Klesges et al., 1990). Parental concern about overweight was associated with lower perceived physical ability among 5-year-old girls regardless of their weight status, while maternal restriction on eating was associated with reduced levels of perceived physical ability only with girls with higher weight status (Davison & Birch, 2001).

Among preschool children, Burdette and Whitaker (2003) found no relation between overweight and proximity to closest playground or fast food restaurant. In a study of the relationship of neighborhood environments to childhood obesity, Timperio, Salmon, Telford and Crawford (2005) found that 10- to 12-year-old children whose parents perceived heavy local traffic in their neighborhood and were concerned about road safety were more likely to be overweight or obese, but there was no association for 5- and 6-year olds.

The National Heart, Lung, and Blood Institute's Growth and Health Study (NGHS) demonstrated that levels of physical activity during adolescence significantly affect changes in BMI and adiposity (Kimm et al., 2005). In this study of 1,152 black and 1,135 white girls between the ages of 9 and 19 from three diverse regions of the U.S, BMI and sum of skinfold thickness (measure of adiposity) were measured once a year, and activity level was assessed at years 1, 3, 5, and 7-10. "This cohort had a pronounced decline in physical activity while their rate of overweight and obesity doubled without a concomitantly large increase in reported energy intake . . . Although there were significant differences in BMI between active and inactive girls even at ages 9 or 10 years, the differences widened by almost three times during the next 9 years" (p. 305). During the first 5 years, rather steep increases in BMI regardless of activity level appear to be related to growth and peak bone mass formation, but drops in physical activity during this period accounted for some acceleration of BMI. Greater differences in BMI at older ages reflect widening differences in activity levels after the growth spurt ended.

Activity levels were classified as active, moderately active, and inactive. Changes in BMI and skinfold thickness for moderately active girls were about midway between those for active and inactive girls. Black girls had higher BMIs and skinfold thicknesses throughout adolescence than white girls. Energy intake was higher for black girls than for white girls and increased over time. Although white girls reported no increase in energy intake during the study, underreporting of energy intake may have occurred (Kimm et al., 2005).

Reducing sedentary activity such as watching television does positively influence the effectiveness of interventions designed to prevent childhood obesity (Robinson, 1999). Children who were rewarded for reducing sedentary behavior (and eating an energy-restricted diet) had significantly greater weight loss than children who were reinforced for increasing physical activity (Epstein, Myers, Raynor & Saelens, 1998).

Hispanic children have nearly twice the risk for overweight as non-Hispanic white children (Grummer-Strawn & Mei, 2004). In a predominantly Hispanic sample of children aged 2-5 who were at or above the 90<sup>th</sup> percentile for weight to height, only 5% of mothers felt that increasing physical activity was a way to control weight (Myers & Vargas, 2000). Staff at a community center serving primarily Hispanic families noted that parents' lack of time is a major barrier to implementing suggestions about both eating and physical activity and that

safety concerns and lack of safe outdoor spaces are a major reason given for being physically inactive (Chatterjee, Blakely & Barton, 2005).

Barriers to physical activity identified by youth ages 7 to 17 have been reported by Gordon-Larsen et al. (2004) and O'Dea, (2003):

- Preference for indoor activities
- Lack of energy and motivation
- Time constraints
- Perceived lack of affordable and accessible recreation facilities
- Low caregiver motivation and lack of awareness of television viewing time

Youth indicated that parents and teachers need to be involved in approaches that would encourage them to be more active (O'Dea, 2003):

- Children across the age range of 7-17 indicated that they would like their parents to be involved with them in outdoor games and activities, and they wish their parents would encourage them to be more physically active.
- Revamping physical education programs by including activities such as aerobics, martial arts, Tai Bo, yoga, archery, hiking and rock climbing would make physical activity more exciting.
- Female adolescents suggested female-oriented sports, female teachers, doors on private showers and changing rooms, and self-selected uniforms.

## **MEDIA INFLUENCES**

"A vast body of literature now exists that attests to the power of the media to influence children's and adolescents' beliefs and, potentially their behaviors as well" (Strasburger & Donnerstein, 1999, p. 133).

Based on differences in the amount of time children watch television reported by Dietz & Gortmaker (1985) and Crespo et al. (2001), Caroli, Argentieri, Cardone & Masi (2004) note that "the rate of children watching television for more than 4 hours per day seems to have increased at the same pace as the rate of overweight and obesity in children" (pg. S105). Television viewing is of particular significance because of its potential influence on both energy intake and energy expenditure (Dietz & Gortmaker, 2001).

In the National Longitudinal Survey of Youth, 1990 to 1998, 17% of 0- to 11-month-olds, 48% of 12- to 23-month-olds, and 41% of 24- to 35-month-olds were reported to watch more television than the American Academy of Pediatrics recommends, and these early viewing habits persisted into childhood (Certain & Kahn, 2002). In a study of low-income preschool children enrolled in the WIC program (Dennison, Erb & Jenkins, 2002), average TV and video viewing times were 14.9, 16.3 and 18.4 hours per week for 2-, 3-, and 4-year-old children, respectively. Of 1-year-olds, 20% did not watch TV or videotapes, but 25% averaged more than 2 hours per day.

Although the amount of children's TV watching is usually inversely related to parents' education, Dennison et al. (2002) found no effect of parent education after controlling for racial/ethnic differences. The authors note that two interventions which reported decreased prevalence of overweight by reducing media time were conducted among "relatively highly educated populations."

Black children have been found to spend the most time watching TV or videotapes, while white children spend the least amount of time (Dennison et al., 2002). In a national study 1988-94, non-Hispanic black children had the highest rate of watching more than 4 hours of television a day (Andersen, Crespo, Bartlett, Cheskin & Pratt, 1998).

Relevant data regarding the availability and parental supervision of media in the home is available in The Fifth Annual Survey of Parents and Children (Woodard & Gridina, 2000, pp. 3-4).

- Almost half (48%) of all families with children between the ages of 2 and 17 have all four of the media staples among families with children: a television, a VCR, video game equipment, and a computer. The average household with children aged 2 to 17 has 2.8 television sets.
- Children in families with heavy television viewing parents (i.e., more than 2 hours per day) spend more time each day watching television and videotapes, playing video games, and surfing the Internet. According to parents, children spend nearly 2-1/2 hours viewing television. Children from low-income households spend 54 minutes more watching television, 30 minutes more watching videotapes, and 27 minutes more playing video games than children from high-income households. Low-income families are less likely to own computers and have Internet access.
- Children who watch less TV are more likely to have parents with lower BMI s and a higher level of education (Proctor et al. 2003).
- Parental concerns about the media are not statistically related to the time their children spend with television.
- Parents are more likely to supervise their children's use of television than they are to supervise use of the Internet or video games.

In focus groups with a well-educated convenience sample, parents of preschool children (mean age 3.4 years) did not recognize television viewing as a potential cause of obesity. Over all, parents were concerned with the content their children viewed but not with the time spent viewing. Obesity was attributed to excessive eating, and physical activity was ironically thought to be increased by television time (He et al., 2005).

#### **Television sets in children's bedrooms**

According to Woodard and Gridina (2000),

- Of children between the ages of 8 and 16, 57% had a television set and 30% had a VCR in the bedroom.
- Children in low-income homes are more likely to have television sets in their bedrooms than children from higher income homes.

- In families in which parents watch television 2 hours or more per day, 57% of children have TVs in their bedrooms compared with 39% in families in which parents watch television one hour or less per day.
- Fewer preschoolers (24%) have television sets in their bedrooms than in previous years. Steadily increasing and at a 5-year high, 48% of elementary age children have bedroom TVs. TVs are in about 60% of adolescents' bedrooms.

In a study of low-income children between ages 1 and 5 years, children with a TV set in their bedroom watched 4.8 hours per week more TV or videotapes than children with no TV in their bedroom. The amount of time spent watching television was significantly related to the prevalence of overweight children (Dennison et al., 2002). For 6<sup>th</sup> and 7<sup>th</sup> grade students, Wiecha, Sobol, Peterson & Gortmaker (2001) found a similar increase of 4.5 hours per week in television viewing when there was a TV in the bedroom.

### **Relationship between obesity and amount of television viewing**

Several review articles report significant evidence of a positive relationship between obesity and the amount of television viewed by youth of various ages (Caroli et al., 2004; Sothorn, 2004). The relationship has been found in cross-sectional studies in children (Dietz & Gortmaker, 1985; Gortmaker et al., 1996) and in pre-adolescents and adolescents (Andersen et al., 1998; Crespo et al., 2001; Lowry, Wechsler, Galuska, Fulton & Kann, 2002).

In a study with approximately 2,000 ethnically diverse ninth grade girls, Robinson et al. (1993) found a weak association, suggesting that TV viewing increased dietary fat intake but did not support a direct relationship to obesity. "The findings of gender and ethnic subsample-specific associations suggest that cultural factors may influence the susceptibilities of children and adolescents to the effects of television viewing" (Robinson & Killen, 1995, p. S91). After adjusting for ethnicity and SES, McMurray et al. (2000) found no association between television viewing and obesity, but noted that their findings suggested that African American adolescents and females of lower SES appear to be at risk for overweight regardless of television time or physical exercise.

DuRant, Baranowski, Johnson and Thompson (1994) concluded that the relationship was less clear among younger children. Vandewater, Shim, and Caplovitz (2004) found a relationship between obesity and video games but not with television viewing. More time was spent in sedentary activities by children with higher weight status than by children with lower BMIs.

Robinson (1998) notes that, whether statistically significant or not, associations in all studies are weak and may be affected by measurement error because of the nature of the variables. While time spent viewing television has been suspected as a cause of obesity, cross-sectional studies cannot rule out the possibility that obesity causes children to watch more television (Robinson, 1998).

While the results of cross-sectional studies cited above do not provide a clear picture of the relationship between TV watching and childhood obesity, support for the notion that

excessive television watching is a cause of childhood obesity was found in several longitudinal studies.

- In the National Health Examination Survey (NHES), prevalence of obesity among 12-17 year olds increased by 2% for each additional hour of television viewing even when controlling for prior obesity, race, and socioeconomic status (Dietz & Gortmaker, 1985).
- In the Framingham Children's study, a longitudinal study of 100 children from preschool to preadolescence, television viewing was found to be an independent predictor of change in BMI and other measures of body fat. The effect was greater for children who were sedentary or had a high-fat diet (Proctor et al., 2003).
- In a 3-year study with 2,223 adolescents 12-17 years of age, adolescents who watched 2 or more hours of television a day were twice as likely to become overweight during the course of the study as those who watched less than 2 hours per day. There was a positive linear relationship both at baseline and at follow-up (Kaur, Choi, Mayo & Harris, 2003).
- In a cohort of 10,769 children 9 to 14 years of age, over a one-year period increases in BMI were greater for both boys and girls who reported spending more time with TV, videos and video games and who reported an increase in caloric intake. Greater increases were also seen in girls who reported a decline in physical activity (Berkey et al., 2000).
- Television viewing and physical activity, along with baseline BMI, predicted BMI three years later in an ethnically diverse sample of 3- and 4-year olds (Jago, Baranowski, Baranowski, Thompson & Greaves, 2005). Both the positive relationship between obesity and television viewing and the negative relationship between obesity and physical activity became stronger as the children aged. TV viewing did not become significant until the third year, suggesting that ages 6 and 7 are a critical time for reducing television time and increasing physical activity. Diet was not associated with BMI at any point in the study.

One longitudinal study did not find an effect of television viewing on obesity (Robinson et al., 1993). This study was conducted for only 2 years with a sample of girls from a highly educated population. Caroli et al. (2004) posit that lengthening the time frame and including boys might have resulted in a different outcome.

Support for the notion that television viewing is causally related to childhood and adolescent obesity comes from an intervention in which the treatment group had statistically significant reductions in BMI and all other measures of body fat, and the only manipulated variable was a reduction of television viewing (Robinson, 1999). There was a statistically significant reduction in the number of meals eaten in front of television for the treatment group but no differences in physical activity, other dietary behaviors or cardio-

respiratory fitness between the groups. This 6-month program addressed school, family, peer and cultural influences and changed teacher behavior as well as student behavior. Although “there is insufficient causal evidence to definitively link [television] advertising directly with childhood obesity,” the success of this intervention suggests that it may be important to consider reducing exposure to media in prevention efforts at the population level (Daniels et al., 2005, p. 2006).

Mechanisms or pathways which may explain an association between television viewing and child obesity are: (Robinson, 2001)

- Increased dietary intake from eating during viewing
- Increased dietary intake as a result of food advertising
- Reduced energy expenditure from television viewing displacing physical activity
- Decreased resting metabolism rate during viewing - Dietz (2004) notes that this rate is familial and not under voluntary control

### **Increased dietary intake during television viewing**

Even if children did not use the time for more physical activity, Robinson (1999) posited that reducing the amount of television time might be preventive because it would reduce the amount of food consumed (Robinson, 1999).

In a sample of 173 non-Hispanic white girls assessed at ages 5, 7, and 9, for girls with one or more overweight parents, the relationship between excessive weight gain and television was mediated by the frequency of snacks and high intakes of fat from energy-dense snacks. For girls with no overweight parent, TV viewing was the only significant predictor of later obesity and was more likely a result of decreased energy expenditure (Francis, Lee & Birch, 2003).

Coon, Goldberg and Rogers (2001) found that the diets of children watching television during meals included fewer fruits and vegetables and more pizzas, snack foods and sodas than the diets of children in families in which television is not watched during meals. There was a close relationship between the presence of television at meals and the number of nights per week parents reported choosing foods that were easy to prepare and readily accepted by the children. The frequency of children's vegetable consumption was negatively correlated with the number of nights per week meals served were “quick and easy”. “Parent's nutrition knowledge had little or no relationship to children's vegetable consumption, which suggests that the cluster of family food behaviors associated with television displaced or crowded out the beneficial effects of nutrition education in regard to children's vegetable intake” (p. 7 of 9).

In the families of less educated mothers, the television was more likely to be on at mealtime, meals were more likely to include meat, and mothers had less knowledge about nutrition. However, the differences in diet between children who did or did not eat while watching TV remained after controlling for socioeconomic status (Coon et al., 2001).

In a school-based screening study of sixth and seventh grade students in three schools, 35% had BMIs at or above the 85th percentile and 17% were at or above the 95th percentile. Rates were higher among Latino and lower among Asian than non-Hispanic white students. There were significant associations between obesity and (a) time spent watching television and (b) the number of soft drinks consumed. Latino students watched more television and consumed more soft drinks than did non-Hispanic white or Asian students (Giammattei, Blix, Marshak, Wollitzer & Pettitt, 2003).

## **Advertising**

The fact that about ¾ of food industry advertising expenditure is allocated to television (Gallo, 1999) is an indication of its effectiveness (American Academy of Pediatrics, 1999; Ostbye, Pomerleau, White, Coolich, & McWhinney, 1993; Strasburger & Donnerstein, 1999).

Recent estimates indicate that, on average, children see 40,000 commercials per year, and most are for food (Kunkel, 2001). In one study, approximately 11 commercials per hour were shown on Saturday morning shows, making intervals between ads about 5 minutes (Kotz & Story, 1994). Kuribayashi, Roberts and Johnson (2001) found that non-program time averaged 15 minutes per hour, 4.5 minutes more than is permitted by the Children's Television Act of 1990. Although ads for children are shorter, they are repeated more often (Kuribayashi et al., 2001). Children may get a double dose if they watch television in the evening with their families.

Food advertising for children and adolescents is geared to specific stages of development, set in pleasant environments of homes, school, and open spaces, and is associated with feelings of happiness, fun, beauty, and fitness (Caroli et al., 2004). Advertisements for food which include offers of toys and/or include cartoon characters with which the children are familiar increase children's request for these foods (Kotz & Story, 1994).

In a randomized controlled trial with 2- to 6-year-olds in a Head Start program, children exposed to a 30-second food ad embedded within a TV program were significantly more likely to prefer the advertised items over similar items than children who saw the cartoon without the ad. The greatest differences between the groups occurred when products were advertised twice during cartoons shown to the treatment group (Borzekowski & Robinson, 2001).

When a small group of 9- to 11-year-olds were shown a series of television ads, the obese children recognized a greater number of food than non-food advertisements, and 60% of the obese children remembered nearly all the food ads. None of the lean children remembered any of the food ads. Remembering ads was significantly related to higher food intake following exposure to these ads for all children, but obese children ate the greatest amount, and the lean children ate the least. Halford, Gillespie, Brown, Pontin and Dovey (2004) suggest that susceptibility to food cues contributes to overeating and promotes weight gain.

Heavier mothers were more likely to purchase the foods their children requested after seeing ads on TV. Overweight mothers also spent more time watching TV with their children (Sallis et al., 1995).

Among children as young as 3, weekly television viewing has been related to children's requests and parents' purchases of foods children saw on television ads (Taras, Sallis, Patterson, Nadar & Nelson, 1989). "Studies suggest that commercials increase preferences in children ages 3 to 4 year for advertised products, and those children who are exposed frequently to television are more likely to have unhealthy perceptions about nutrition" (Sothorn, 2004, p. 705).

A study of 427 4<sup>th</sup> and 5<sup>th</sup> graders demonstrated that there is a positive relationship between watching television and expressing preferences for more unhealthy foods. When given a choice of similar products with varying levels of nutrient content, children who watched more television were more likely to choose the less healthy product. For every additional hour of television per day, student consumption of fruits and vegetables declined (Signorielli & Staples, 1997).

"It has been widely demonstrated that food shown during programmes, both for children and adults, does not meet the criteria of healthy nutrition" (Caroli et al., 2004, pg. S105).

Kuribayashi et al. (2001) compared commercials during Saturday morning and Saturday evening programming on four national networks during 1997. They calculated the actual nutrient content (i.e., total amount of calories, calories from fat, saturated fat, sodium, cholesterol and sugar) of the advertised foods and rated the nutrient value based on USDA standards. Although food advertisements in both time frames promoted largely unhealthy foods, programming aimed at children had a greater number of food commercials and advertised foods which were higher in sugar content and cholesterol. The average number of calories for advertised foods was over 400 calories per child serving, and more than 40% of the calories came from fat in ads for both children and adults. None of the ads included fruit and vegetables.

Over a 5-week period, Harrison and Marske (2005) taped 40 hours of the television programs most popular with 6-11 year olds according to Nielsen Media Research. A nutrient analysis of foods advertised on these programs revealed that 83% of the ads were for convenience/fast foods and sweets. A 2000-calorie/day diet composed entirely of these foods would result in excessive intake of sugar and sodium but insufficient intake of dietary fiber, Vitamins A and C, calcium, and iron. Food consumption in the ads occurred as snacks more often than breakfast, lunch, and dinner combined.

Ads for convenience foods (canned desserts, frozen dinners, and fast foods) have more than doubled since the 1980s (Gamble & Cotugna, 1999). Jeffery and Utter (2003) note that the most extensively studied environmental exposures considered to be potential causes of obesity are TV viewing and convenience foods. Although the associations for both are inconsistent and sometimes weak, both have strong associations with social class that may be difficult to control for statistically. "In addition, both television viewing and the

consumption of convenience foods are high-frequency behaviors that are almost certainly embedded in larger diet and physical activity patterns. Thus, they may be symbols identifying obesity-promoting lifestyles rather than unique, independent causal agents" (Jeffery & Utter, 2003, pg. 17S).

Hernandez et al. (1999) found no association between obesity and other forms of media use (video tapes and video games) and speculated that it might be due to the smaller amount of time those media forms are used or to different energy levels during video game playing versus watching television. It might also be due to another variable such as absence of food advertising (Hernandez et al., 1999).

Caroli et al. (2004) do not consider it a coincidence that European countries which have stricter regulations on food advertising on children's television programming have lower prevalence rates of child obesity than countries which have either no legislation or little compliance with regulations.

Lobstein and Dobb (2005) found support for a link between TV food advertising and child overweight in a study which examines the association between (a) the average number of TV advertisements for food and entertainment per 20 hours of children's TV in 1996 in the US, Australia and 8 European countries and (b) prevalence rates of childhood obesity reported in major studies between 1991 and 2002 in each country adjusted to the 1996 level, using the 0.5% annual increase in prevalence rates reported by Lobstein et al. (2004). Food categories in the ads are sweet/fatty, healthier, and other. Also included are the average number of ads for non-food items, entertainments, and a composite category for ads which might support a weight-gaining lifestyle (i.e., sweet/fatty foods and entertainments) labeled "all obesogenic."

- The US had the highest prevalence rate at 26%. Other prevalence rates ranged between 19.9% in Australia and 12.3% in the Netherlands.
- A major proportion of ads in all countries featured food (39-84%). At most, ads for healthier foods constituted 6% of *all* ads.
- The correlation coefficient between overweight prevalence and (a) average number of TV ads for sweet/fatty foods was .86 ( $p < .005$ ) and (b) the "all obesogenic" category was .085 ( $p < .005$ ).
- In contrast, the correlation coefficient of -0.56 ( $p < 0.10$ ) between overweight prevalence and ads for healthier foods suggests some positive benefits from this type of food advertising.
- "The size of the correlation coefficients implies that advertising could explain up to half of the variation between the different countries' overweight prevalence figures, but that still leaves considerable variation to be accounted for, and it leaves the base levels unexplained: the levels of overweight among children even in countries with low levels of obesogenic television advertising are still higher than they were one or two decades earlier, indicating that additional factors must also bear responsibility" (p. 207).

The Institute of Medicine study (2005) concluded that "There is presently insufficient causal evidence that links advertising directly with childhood obesity and that would support

a ban on all food advertising directed to children" (p. 174). Instead, the committee recommended an approach that is similar to that used for controlling cigarette or alcohol advertising; i.e., "an approach to address advertising and marketing directed especially at young children under 8 years of age, but also for older children and youth, that would first charge industry with voluntary implementation of guidelines developed through diverse stakeholder input, followed by more stringent regulation if industry is unable to mount an effective self-regulating strategy" (p. 175).

The American Psychological Association has recommended restrictions on advertising to children under the age of 8 because they do not have the capacity to discern facts from unsupported claims (American Psychological Association, 2004). Children would benefit from policy efforts to make companies more accountable for nutrition information in TV ads (Kuribayashi et al., 2001).

"Nutrition education with parents should include information about how television affects children in terms of activity and attitudes . . . Parents may need to take a more active role in counteracting the commercials' messages (although they are likely influenced themselves). Parents who become educated about media literacy can become day-to-day instructors in shaping how children view commercials and other television programming" (Kuribayashi et al., 2001, p. 320). In the Netherlands, researchers found some evidence that parent mediation helps to reduce the effects of television advertising on children's purchase requests (Buijzen & Valkenburg, 2003). Parents can also influence this behavior by limiting television time for their children and themselves (Harrison & Marske, 2005).

Media literacy training for elementary school students has been shown to make children better able to evaluate advertisements critically (Dorr, Graves & Phelps, 1980). The potential benefit of parent involvement and media literacy in cultivating child resistance to advertising is limited by cognitive development at particular stages (Kunkel, 2001).

A randomized controlled trial in 16 preschools and day care facilities with children aged 2.6 to 5.5 years demonstrated effectiveness in reducing television viewing among the intervention group, while hours per week of television watching increased in the control group. The percentage of children who watched television or videos 2 or more hours per day declined in the treatment group but increased in the control group. An early childhood teacher and a music teacher presented 7 sessions as part of the Brocodile the Crocodile health promotion program. Parents were involved in supporting children's alternate activities, turning off the TV at mealtime, and reporting on television time (Dennison, Russo, Burdick & Jenkins, 2004).

### **Decreased physical activity**

In the data from the 1999 Youth Risk Behavior Survey, a nationally representative sample of 15,143 U.S. high school students, Eisenmann, Bartee & Wang (2002) found a stronger relationship between television viewing and BMI (positive) than between physical activity and BMI (negative). Greater levels of physical activity were also associated with less television viewing.

Girls and ethnic group minorities (Hispanics and African Americans) had lower levels of physical activity and higher rates of TV watching than boys and white students, respectively (Eisenmann et al., 2002). These findings may be of particular significance because “a recent series of papers shows that adolescence is marked by the greatest annual decline in physical activity throughout the lifespan” (p. 383, citing Sallis, 2000).

In a national study 1998-94, Andersen et al. (1998) found that 80% of US children reported 3 or more episodes of vigorous activity each week, but the rate was lower in non-Hispanic black and Mexican American children. Non-Hispanic black children had the highest rate of television viewing, and children who watched 4 or more hours per day had greater body fat and greater BMI.

A similar relationship was found among Pima Indian children at ages 5 and 9, with a decline in physical activity between 5 and 9 among the children who were overweight at 5. The researchers recommended both increased physical activity and reduction in television viewing time for these at-risk children (Salbe et al., 2002).

Janz et al. (2002) concluded from a study of children 4-6 years old, that vigorous activity and TV viewing may independently affect fatness. “High levels of physical activity may not protect against long periods of sedentary activity and associated gains in adiposity” (p. 568). Children who engaged in vigorous active play for more than 30 minutes had the lowest percentage of body fat. At this stage which is a critical period for the development of adipose tissue, increasing physical activity and decreasing television time is recommended (Janz et al., 2002).

All studies do not find a strong relationship between physical activity and television time. Weak inverse relationships were found between television viewing and physical activity in young children (DuRant et al., 1994) and a diverse sample of adolescent girls (Robinson et al., 1993). Lindquist, Reynolds and Goran (1999) found in their small sample that children who watched more television did not necessarily engage in less physical activity.

Interventions which only reduce television time may not result in increased physical activity. Time may be spent in sedentary activities such as reading or playing board games. Greater weight loss resulted from reinforcing a decrease in sedentary behavior (TV viewing) than from reinforcing greater exercise (Epstein, Valoski, Vara et al., 1995). It may be that “choice and control over available time are more motivating than direct reinforcement for exercise” (Robinson, 1998, pg. 960).

### **Eating and Physical activity**

A stronger relationship between eating and TV viewing than between physical activity and TV viewing might be due to increased eating rather than decreased physical activity. In a sample of 9-16 year olds from low- and middle-income families in Mexico City, Hernandez et al. (1999) estimated a 12% greater risk for each additional hour of TV viewing per day and 10% lower risk for each hour of moderate vigorous physical activity per day. The risk from

TV viewing was smaller than the 20% risk reported in a longitudinal study in the USA (Gortmaker et al., 1996). Children in low-income families had less risk of obesity, the opposite situation found among Mexican-American children in the U.S.

### **Other potentially negative effects of media**

Both human and cartoon characters are more often snacking than eating meals and drinking soft drinks or alcohol rather than water (Story & Faulkner, 1990). Despite the eating habits portrayed, most characters are thin. Heroic characters are typically thin; funny characters may be fat (Kaufman, 1980). Thin female characters are portrayed as attractive and have more male attention, whereas fat girls have less social interaction, fewer friends and usually no boy friend (Greenberg, Eastin, Hofshire, Lachlan & Brownell, 2003). Programming aimed at African American audiences featured more overweight characters and had more advertisements for soft drinks and candy than programming prepared for general audiences. The fact that more characters were younger may reflect an expectation of a younger audience and their increased vulnerability to advertising (Tirodkar & Jain, 2003).

Obese children watch more television (Dietz & Gortmaker, 1985; Moreno, Fleeta & Mur, 1998) and are thus exposed for longer periods of time to bad advertising and to negative stereotyping. Children begin modeling adult behavior as early as one year of age, especially behavior of powerful people (Meltzoff, 1998). In a group of 6-10 year olds, when asked which television character they would most like to be similar to, obese children chose cartoon or imaginary characters, and normal-weight children chose sports or cultural personalities. None of the characters was obese (Caroli, Pace & Chiarappa, 1992).

## **FAMILY, HOME ENVIRONMENT, AND CHILDREN'S MENTAL HEALTH ISSUES**

Parental obesity is a major risk factor for childhood and adult obesity.

- “. . . family and sibling, twin, and adoption studies support the view that genetic factors contribute to fatness” (Parsons et al., 1999, pg. S1). Parental obesity as a risk factor is both genetic and environmental, although the proportion of effect is unclear.
- The risk of obesity at 2 to 4 years of age is more than double in children whose mothers are obese in early pregnancy compared to other children. In a sample of about 8500 low income mothers in a WIC program, one in four children born to a mother who was obese in early pregnancy was overweight by age 4 compared to one in 10 children of the same age born to a mother who was not obese in that time period (Whitaker, 2004a).
- “Overweight families of low SES have the highest risk of overweight and obese children” (Danielzik et al., 2004, p. 1494).
- A child with one obese parent is 3 times as likely to be obese as an adult as a child who has no obese parent; a child with two obese parents, more than 13 times as likely to be obese as an adult. Parent obesity is a stronger predictor of adult obesity than the child's weight status before age 3 (Whitaker et al., 1997).

- Maternal obesity is predictive of obesity during middle childhood (Strauss & Knight, 1999).
- Among parents who correctly perceived themselves as overweight, 32% of their children were overweight. Among overweight parents who did not perceive themselves to be overweight, 42% of their children were overweight (Varyiyam, 2001).

Child obesity is associated with low levels of cognitive stimulation in the home (Troiano & Flegal, 1998).

- Strauss and Knight (1999) found a twofold increase in risk for obesity among children with low levels of cognitive stimulation compared to children with the highest levels of cognitive stimulation. There was some risk with a moderate level. Risk decreased only in an environment of high cognitive stimulation. The effect remained after controlling for maternal obesity, initial weight-for-height z-score, gender, socioeconomic factors, race, marital status, and television viewing. The association is of particular concern because minority children and children with lower socioeconomic status generally have the poorest home environment and the highest levels of obesity. The researchers speculate that, in homes where cognitive stimulation is low, TV substitutes for physical activity.
- A positive relation between low cognitive stimulation in the home and obesity was also found in a study of the effects of center-based child care. The association of low cognitive stimulation and obesity was independent of the experience of child care. Being in center-based child care was not related to later obesity (Lumeng, Gannon, Appugliese, Cabral & Zuckerman, 2005).
- These findings are consistent with the association between obesity and neglect and dilapidated living conditions, irrespective of parents' education and occupation, found by Lissau, Sorensen & Lissau (1994).

Strauss and Knight (1999) suggest that the conclusions reached by Lissau et al. (1994) may have suffered from confounding of the effects of low income because they found no relation between lack of family emotional support and obesity (Strauss & Knight, 1999). Obese children were as likely to be hugged, spanked, and kissed as non-obese children.

Outside the home, obese children face the stress of social stigmatization (American Academy of Pediatrics, 2003) and teasing (Daniels et al., 2005). Teasing has been related to suicide and suicidal ideation (Eisenberg, Neumark-Sztainer & Story, 2003) and disordered eating among adolescents (Neumark-Sztainer et al., 2002). Obesity in 8-11 year olds has been associated with clinically meaningful behavior problems (Lumeng, Gannon, Cabral, Frank & Zuckerman, 2003). One route to psychopathology for overweight children might be through compromised peer relationships (Daniels, et al., 2005).

In the 1996 The National Longitudinal Study of Adolescents, overall "adolescents with above normal body mass did not report poorer emotional, school, or social functioning" (Swallen, Reither, Haas & Meier, 2005, p. 340). However, among younger adolescents, the

12- to 14-year olds, there was a deleterious effect of obesity on self-esteem, depression, and school/social functioning. For all adolescents, there was a significant negative association between BMI and physical health.

A significant statistical association between obesity and depression was found among 4,703 Swedish adolescents 15-17 years of age in the Survey of Adolescent Life in Vestmanland (Sjoberg, Nilsson & Leppert, 2005). Those with the highest BMI s experienced the highest levels of depression based on DMS-IV criterion. "Effects of experiences of shame, parental separation, and parental employment explain this association" (p. e392). Shame was defined as experiences of being degraded and ridiculed by others. Treatment suggestions include dealing with issues of shame and social isolation as well as diet and exercise.

## CULTURAL AND SES ISSUES

[Note: Information about cultural and socioeconomic influences and differences are reported in many sections of this document and are not repeated here.]

Douchis et al. (2001) discuss several culturally and biologically based risk and protective factors which may interact to influence the prevalence of obesity in minority groups.

- The relation between socioeconomic status (SES) and obesity appears to be bi-directional (Slobal, 1995). Lower SES appears to influence health-related behaviors and values, such as education about nutrition; and weight appears to influence SES through discrimination and social mobility.
- Reduced energy expenditure and increased television viewing appear to play a role.
- Eating habits vary by ethnic group, and mothers' levels of education and acculturation further influence dietary intake.
- Gene-environment interactions in racial/ethnic groups are not well understood.
- Puberty occurs earlier in some cultural groups.
- While a preference for larger body types among Hispanic and black women serves as a protective mechanism for self-esteem, it does not serve as a protective mechanism against obesity.

In a guide to cultural competency for health care workers, Purnell and Paulanka (2005) describe cultural preferences for body size and recommend enlisting these clients as co-participants in deciding an acceptable weight. For Cuban clients, they added: "Counsel clients about the difference between being overweight and obese and the health hazards associated with obesity. Incorporate clients' traditional and preferred food choices into nutritional health planning" (p. 120).

- People of African American Heritage - "Being overweight is seen as positive. In the African American community it is common to view individuals who are at an ideal body weight as 'not having enough meat on their bones.' It is important to have meat on one's bones to be able to afford weight loss during times of sickness" (p. 27).
- People of Cuban Heritage - "Being overweight is seen as positive, healthy, and sexually attractive" (p. 120).
- People of Mexican Heritage - "Being overweight is seen as positive" (p. 343).

- People of Puerto Rican Heritage – “Being overweight is a sign of health and wealth. Some individuals eat to excess believing that if they eat more, their health will be better. Efforts directed at weight control may be considered Americans’ excessive preoccupation with a thin body image” (pp. 377-378).

In a study of students in grades 4-6 and their parents, few ethnic group differences were found in child-reported family and peer influences on children’s fruit, juice, and vegetable consumption (Cullen et al., 2002). This is consistent with an earlier report of dietary trends which showed little difference between whites and blacks on all socioeconomic levels (Popkin, Siega-Riz, & Haines, 1996). However, a negative association has been found between an authoritarian parenting style and the consumption of fruits, juice and vegetables (Cullen et al., 2000; Patrick, Nicklas, Hughes, & Morales, 2005).

In a survey of WIC health care professionals concerning the challenges of preventing and treating obesity in low-income, preschool children, twelve major themes clustered into three domains (Chamberlin, Sherman, Jain, Powers, & Whitaker (2002).

- ❖ Life experiences, attitudes and behaviors of the mothers
  - Focused on surviving their daily life stresses
  - Used food to cope with these stresses and as a tool in parenting
  - Had difficulty setting limits with their children around food
  - Lacked knowledge about normal child development and eating behavior
  - Were not committed to sustained behavior change
  - Did not believe their overweight children were overweight
- ❖ Perceptions of counseling interactions
  - Concerned that they would offend mothers when talking about weight
  - Counseling was driven by protocols
  - Nutrition advice often conflicted with the advice from mothers’ relatives, friends, or primary care physicians
- ❖ Suggestions offered to address childhood obesity
  - Promote a more client-centered approach
  - Establish behavioral change goals that are small and endorsed by the mother
  - Work with primary care physicians to create a more uniform approach to counseling

A statewide campaign to reduce television viewing by clients and staff of WIC was undertaken as a pediatric obesity prevention effort. Following a 3-week intervention, the percentage of WIC clients reporting watching 2 or fewer hours of television per day rose from 64.2% to 70.5% (Johnson, Birkett, Evens & Pickering, 2005).

Health consciousness and more nutritious dietary patterns have been associated with higher levels of parents’ education (Kranz & Siega-Riz, 2002; Xie, Gilliland, Li, & Rockett, 2003) and greater income (James, Nelson, Ralph & Leather, 1997). Jain et al. (2001) speculate that “lack of parental control and unrestricted eating may contribute to obesity in the low-

income population” (pg. 1144) and that interventionists should focus more on general parenting skills and less on discussing the child’s growth.

Drewnowski and Darmon (2005) discuss their hypothesis that the link between obesity and poverty is through economic issues related to the cost of a healthy diet, use of fast food rather than full service restaurants, and less access to sources of healthier foods. To provide an affordable supply of fresh nutrient-rich foods, the authors recommend that broad interventions focus on a combination of agricultural subsidies, pricing policies, regulatory action, and consumer education.

The Institute of Medicine study (2005) recommends that local governments “work with community groups, nonprofit organizations, local farmers and food processors, and local businesses to support multisectoral partnerships and networks that expand the availability of healthful food within walking distance, particularly in low-income and underserved neighborhoods” (p. 217).

## **CHILD CARE AND PRESCHOOL ISSUES**

In a nationally representative sample in the U. S., Lumeng et al. (2005) found:

- Limited attendance at a child care center from ages 3-5 was independently associated with a decreased risk of childhood overweight at ages 6 -12. Centers providing part-time care may have more structured physical activity or different feeding patterns. Parents may have more financial stability, flexible work schedules, more extensive social networks, and live in more resource-rich communities.
- Extensive attendance was not independently associated with overweight between ages 6 and 12 relative to no child care attendance.
- Children having no day care were more likely to live in poverty and have less stimulating home environments. Hispanic and black families were less likely to use part-time care.

In an assessment of 24-hour food intakes for 358 children in Head Start Centers, energy intake was below 100% of recommendations, but intake of total fat, saturated fat and cholesterol exceeded recommendations (Bollella et al., 1999). Another study showed children in full-time day care had a higher percentage of their diet as fat than children in part-time care (report Anonymous, USDA, Early childhood and child care study: Summary of findings, 1997).

Bollella et al. (1999) recommend technical training for child care meal planners to increase nutrient density, but not fat density, of meals and snacks of children in day care, particularly for those in part-time care. Moore et al. (2005) concur in that recommendation based on interviews with child care providers and a review of diet quality in a randomized quota sample in the United Kingdom. Although the providers felt responsible for providing a healthy diet, few had any formal training in nutrition and “current dietary guidance was perceived as too vague to be useful” (p. 207).

Benchmarks for nutrition programs in child care settings have been provided by the American Dietetic Association (2005). The position paper “provides guidance and information about resources for nutrition professionals, health care practitioners, child care providers, and parents regarding meal plans, food preparation and food service, physical and social environment, and nutrition consultation and training for child care” (p. 979).

Ogden et al. (1997) recommend that child care providers be given more education related to diet and physical activity. They can play a significant role in the formation of healthful eating and physical activity patterns during the early years when habits are being formed (Rowland & Freedson, 1994; Sallis et al., 1992).

In addition to healthful meals, providing nourishing morning, afternoon (and evening if applicable) snacks is recommended. Snacks can provide nutrients such as calcium and iron that are often slighted in children's diets (McConahy et al., 2002).

Although the objective was a “heart healthy diet” rather than obesity prevention, the “Healthy-Start” program demonstrated that food service intervention can improve the quality of meals for preschool children. Training workshops for cooks and monthly site visits to review progress towards goals resulted in reducing the fat and saturated fat content of meals for preschool children without compromising nutrient value (Williams et al., 2002).

## **CRITICAL PERIODS**

Several stages have been identified as critical periods for the development of obesity (Dietz, 1994).

### **GESTATION AND BIRTH WEIGHT**

A retrospective analysis of data for 252 American Indian children and mothers in the WIC Special Supplemental Nutrition Program suggests an early influence of maternal smoking during pregnancy on child overweight at age 3 (Adams, Harvey & Prince, 2005). “Despite being smaller at birth, the children of smoking mothers had a significantly ( $p < 0.05$ ) greater increase in weight-for-length  $z$  score between birth and age 3 y than did children of nonsmokers” (p. 393.)

In a longitudinal study of 3,022 children followed from birth to age 7, childhood overweight when children were between 24 and 49 months of age (Time 1) was related to maternal prepregnancy overweight (i.e., BMI of 30 or greater), smoking during pregnancy, black race and Hispanic ethnicity (Salsberry & Reagan, 2005). Child BMI s were assessed again between 48 and 72 months of age (Time 2) and between 72 and 95 months (Time 3). “The greatest risk for overweight [at these later times of measurement] is the child's having been overweight in the previous observation period” (pg. 1335).

The associations between childhood overweight and (a) prepregnancy overweight and (b) prenatal smoking are not understood but could be “through biological processes and/or as markers for obesogenic (sic) environments” (Salsberry & Reagan, 2005, pg. 1337). Maternal prepregnancy overweight continued to be a risk factor for children at Times 2 and 3 and suggests that “the effect of maternal prepregnancy weight not only is the result of an early, persistent propensity to overweight but also affects the dynamics of the process of the development of childhood overweight” (p. 1335). These findings support the need to

- counsel women planning pregnancies of the efficacy of attaining a BMI under 30 prior to conception
- counsel women who smoke to quit because of the potential negative effects upon the fetus and child
- monitor closely the weight status of children between the ages of 2 and 4 years and begin intervention for those who are overweight.

[See pages 10-11 for research findings concerning maternal pre-conception overweight and breastfeeding and page 11 for the relation between smoking during pregnancy and breastfeeding.]

Smoking during pregnancy has been related to

- lower birth weight (Power, Li, Manor & Smith, 2005)
- weight gain at various stages of development (Conter et al., 1995; Ong et al., 2000; Reilly et al., 2005)

“There is as yet no good evidence that any associations between birth weight and subsequent weight or fat distribution are the result of intrauterine programming” (Rogers et al., 2003, p. 775). Although some researchers claim that there is a direct positive relationship between birth weight and BMI attained in later life (Parsons et al., 1999), Rogers et al. (2003) note that the relationship is only well established for young white adults and children. High birth weight was associated with obesity but not overweight among 5-7 year-old children in the Kiel Obesity Prevention Study (Danielzik et al., 2004) and in the Avon longitudinal study (Reilly et al., 2005).

There is less certainty about the effects of high birth weight among middle-age subjects and people in nonwhite ethnic groups. Although adult BMI appears to be highly associated with parental BMI, there is some evidence that there is an independent relation between birth weight and BMI in childhood (Rogers et al., 2003). Effects may be due to postnatal conditions.

There are suggestions that higher birth weights may actually be related to a subsequent reduction in adiposity (Rogers et al., 2003). Babies considered small for gestational age are disproportionately fat, whereas babies who are large for gestational age have a greater proportion of lean tissues relative to body fat (Hediger et al., 1998).

Lower socioeconomic status is associated both with higher maternal BMI in developed countries (Power & Parsons, 2000) and low birth weight babies (Rogers et al., 2003).

An association between low birth weight and childhood obesity may be mediated by rapid weight gain during the early months, as these babies “catch up” to normal weight babies (Power et al., 2005; Stettler et al., 2002).

## **INFANCY/TODDLERHOOD**

In a large, diverse cohort of U. S. children, those with the most rapid weight gain during the first 4 months of life were more likely to become overweight as children than those with slower rates of weight gain, independent of birth weight and attained weight at the age of 1 year. The risk for overweight status 7 years later increased by approximately 30% for each 100 gram weight gain increase per month. “Nearly 20% of the overweight status at age 7 years could be attributed to having a rate of weight gain during the first 4 months of life in the highest quartile” (Stettler et al., 2002, p. 197). High rates of weight gain in the first 12 months and catch-up growth between birth and two years were associated with obesity at age 7 in the Avon longitudinal study (Reilly et al., 2005). Ong et al. (2000) found the same relationship of low birth weight to overweight at age 5.

Birth weight normally doubles during the first 4-6 months. “This represents the greatest proportional weight gain in the postnatal life cycle and, therefore, may correspond to a critical period for the development of obesity and energy balance regulation mechanisms” (Stettler et al., 2002, p. 198).

Infants born to mothers who were obese in early pregnancy are at higher risk for obesity at ages 2 to 4 (Whitaker, 2004a). Special preventive effort is warranted with these infants.

## **PRESCHOOL**

Based on prevalence rates among 3- to 5-year olds, prevention efforts should begin before the age of 3 and focus on increased physical activity and improved diets (Canning, Courage & Frizzell, 2004; Ogden et al., 1997). This is an important time because eating habits and patterns are being formed (Caroli et al., 2004).

Body mass index (BMI) increases during the first year of life, declines, and begins rising again sometime between the ages of 4 and 7. “Adiposity rebound” or “BMI rebound” is the time at which BMI reaches its nadir and begins to increase. Mean ages for adiposity rebound (AR) vary across studies from 4.7 to 6.1 years for males and from 4.5 to 6.0 years for females (Rolland-Cachera et al., 1984; Siervogel et al., 1984; Skinner et al., 2004) and 5.5 years with genders combined (Whitaker et al., 1998).

Skinner et al. (2004) notes that the earlier ages of 4.7 years for males and 4.5 years for females found in their more recent study may reflect a societal change, which includes greater media use by children, changes in energy intake, and a reduction in physical activity. Earlier adiposity rebound has been found to occur among less active children (Deheeger, Rolland-Cachera & Fontvielle, 1997). A high protein intake at ages 1 to 2 years predicted an earlier adiposity rebound (Rolland-Cachera et al., 1995).

Among children in the Avon longitudinal study, Reilly et al. (2005) found early adiposity rebound to be a risk factor for obesity at age 7. Children who experience adiposity rebound at an earlier age have been found to be at greater risk for adult obesity (Ogden et al., 1997; Whitaker et al., 1998). However, in their small all-white sample of children of middle and upper socioeconomic status, Skinner et al. (2004) found a reverse association between the age of adiposity rebound and BMI at age 8.

Dietz & Gortmaker (2001) suggest caution in reaching conclusions about this issue because no one has demonstrated that the period of adiposity rebound is associated with increased fatness. If the age of adiposity rebound is determined to be predictive of later obesity, it could be used to identify children at risk (Daniels et al., 2005).

Children who slept the least at age 30 months were more prone to obesity at age 7 than children who spent more hours sleeping (range 10.5 to 12 hours per day). Reilly et al. (2005) suggest that sleep duration may be related to secretion of growth hormone, a child's exposure to obesity-related factors in the environment such as evening snacking, or the amount of physical activity during the day

## **PUBERTY & ADOLESCENCE**

A recent report of the risk levels for adult obesity on the basis of BMI during childhood and adolescence confirms that adolescence continues to be a critical period (Guo, Wu, Chumlea & Roche, 2002). Being overweight during adolescence is the greatest risk factor for adult obesity. Up to 80% of obese adolescents will be obese adults (Daniels et al., 2005).

## **EARLY IDENTIFICATION OF CHILDREN AT-RISK**

### **PERIODIC ASSESSMENT BY PROFESSIONALS**

Recommendations for early identification of individuals and populations at risk: (de Onis, 2004).

- 1) Periodic calculation and plotting of height and weight to monitor weight-for-height and BMI
- 2) Assessment of all children to age 18
- 3) Interpretation of weight-for-height and BMI data using prescriptive reference data, which is now available for preschool but is still needed for older children
- 4) Early intervention when there is an increase in any indicator of overweight or obesity. Professionals and parents should work together on intense prevention efforts.

In a large primary care practice serving a predominantly urban, minority, low-income population, a review of charts for 3 months revealed that providers identified obesity as a problem for only one-half of the obese children examined. Children under 5 years of age and those with milder degrees of obesity were least likely to be properly identified. Appropriate

identification was lowest among preschool children (31%) and highest among adolescents (76%) (O'Brien, Holubkov & Reis, 2004).

## PERCEPTIONS OF PARENTS

Helping parents correct misperceptions about a child's weight is a necessary first step in addressing obesity prevention issues (Etelson, Brand, Patrick & Shirali, 2003). However, when parents do not acknowledge standard definitions of overweight, encouraging them to provide a healthy diet and to keep children active may be more productive than insisting on the recognition of weight status (Jain et al., (2001).

- In a predominantly Hispanic sample of parents and children aged 2-5 who were above the 90<sup>th</sup> percentile for weight and height, 35.5% of parents did not perceive that their children were overweight, and 43% thought their children's weight was fine (Myers & Vargas, 2000).
- In focus groups with 18 low-income mothers of preschool children who were at or above the 85<sup>th</sup> percentile of the growth charts, mothers did not define obesity in relation to the charts. Mothers' did not consider their children overweight unless they were being teased about overweight, had limitations to physical activity, or appeared to be thick or solid. Children who were active and had a good diet and appetite were not considered obese. Mothers felt they had little influence on their children's body development, had difficulty denying their child food when the child claimed to be hungry, and had limited control over others who fed their child. They were disturbed that professionals used the charts instead of individualizing the assessment to their child and family (Jain et al., 2001).
- In the Third National Health and Nutrition Examination Survey (1988-1994), nearly one third of mothers misclassified overweight children as being of normal weight. Daughters at risk for overweight were more likely to be identified as being overweight than sons. No differences were seen by race/ethnicity (Maynard, Galuska, Blanck & Serdula, 2003).
- A greater acceptance of large body size among African American women (Kumanyika, Wilson & Guilford-Davenport, 1993) may have an effect on their perceptions of the weight status of their children.

Rather than see these mothers' responses as denial, it may be more useful to try to understand the complex nature of parenting in this population (e.g., influence of black grandmothers) and how it affects food intake and energy expenditure (Bronner et al., 1999).

Baughcum et al. (2000) found a greater tendency for obese mothers to recognize when their overweight children were overweight. Mothers who recognized this were, as expected, also more concerned about their children being overweight.

Efforts to raise parental awareness of overweight must use approaches which do not result in detrimental effects on children's mental health. Among well-educated white families, a lower sense of self-concept (body esteem and perceived cognitive ability) has been found in girls with higher weight status as young as 5 years of age. Parental concerns about weight which are translated into restrictions on children's eating are associated with negative assessment of self among girls with higher weight status but not with girls of appropriate weight. Maternal concern about overweight was associated with a reduced sense of cognitive ability for all girls, while maternal restriction of eating was associated with a reduced sense of physical ability and cognitive ability only for girls with overweight status (Davison & Birch, 2001).

Awareness that their own or their child's weight was above average, having an overweight older child, and a perception that their child's weight status was a health problem were found to be factors in parents' readiness to make lifestyle changes for the benefit of an overweight child (Rhee et al., 2005). All the children were at risk for overweight or were overweight, were mostly Hispanic and black, and were patients at an inner-city hospital-based pediatric practice. These findings may not be generalizable to all populations. Cultural beliefs and socioeconomic factors also affect perceptions which led to this level of readiness.

#### **PERCEPTIONS OF CHILDREN AND YOUTH**

Negative attitudes toward overweight body builds have been seen in two groups of preschool children aged 3 to 5 years of age (Cramer & Steinwert, 1998). The feelings were stronger among 5 year olds than the younger children. Girls displayed a more negative attitude in tasks related to an ideal self and playmate preference than boys. Overweight children had stronger negative attitudes than children who were not overweight, and the majority of overweight children rated their own body size as thin, a finding which may reflect their sense of body size stigmatization.

In interviews with preschool children (mean age of 5.2) to determine if children understand what "diet" means, Holub et al. (2005) found that girls and heavier children were more aware of dieting behaviors and to some extent engaging in food restraint. Children generally did not understand the meaning of the word but most often linked it to drinks. The authors suggest that the word "diet" not be used in assessing eating behaviors in preschool-age children.

In the Early Childhood Longitudinal Study, with a large nationally representative sample, the lower test scores for overweight children compared to normal-weight children found at the beginning of kindergarten were also seen at the end of first grade. The differences were attributable to socioeconomic characteristics, including parent education and home environment. However, because their classmates are more likely to make judgments based on appearance rather than unseen factors and to associate poor academic performance with overweight, lower academic achievement may add to the stigma of being overweight (Datar, Sturm & Magnabosco (2004).

Among a large group of Swedish 10-year-olds, 20% of girls perceived themselves as fat, although only 31% of girls who perceived themselves as fat were overweight. Only 33% of boys who perceived themselves as fat were actually overweight. Boys and girls who were overweight had more negative body self-esteem than normal weight children (Erling & Hwang, 2004).

## INTERVENTIONS

“Although intensive short-term interventions addressing one or two issues show the greatest change in weight status in children, multicomponent programmes that address a range of strategies are deemed to hold the most promise” (Gill, King & Caterson, 2005, p. 258). Intense interventions in small groups and involvement of the entire family have shown the greatest benefits, but there is too small a body of research available to guide the development of consistently effective interventions.

As a guide to interventions, Gill et al. (2005, p. 258) include a table developed by the World Health Organization (2002) listing factors which decrease or increase risk for obesity in children and adults and showing the level of evidence for each factor.

Evidence	Decreases risk	Increases risk
Convincing	Regular physical activity High dietary fiber intake	High intake of energy-dense foods Sedentary lifestyle
Probable	Home and school environment that supports healthy food choice for children Promoting linear growth [Linear growth is normally increasing height with age.]	Heavy marketing of energy-dense foods and fast foods outlets Adverse social and economic conditions in developed countries (particularly for women)* Sugar-sweetened soft drinks and juice
Possible	Low glycemic index foods Breast-feeding	Large portion sizes High proportion of food prepared outside of homes Rigid restraint and/or periodic disinhibition eating patterns
Insufficient	Increased eating frequency	Alcohol

\* Low income is associated with risk factors for obesity such as

- 1) Limited accessibility and availability of nutritious foods such as fruits and vegetables
- 2) Food insecurity which may result in consumption of foods which are high in calories but low in nutrition
- 3) Chaotic living conditions which often lead to disorganization and inconsistency in parenting
- 4) Lack of safe outdoor recreational areas

Daniels et al. (2005) suggest that prevention efforts should be implemented at the population level as well as at the individual level.

- Population approaches – A focus on environmental and policy change has the broadest reach and lowest intensity and cost. It is critical for reaching the least-advantaged population segment.

- Individual approaches – Treatment approaches are important for children already overweight. Prevention efforts focused on children at risk resemble treatment approaches in process and delivery; and they are highly expensive, intensive, and have low reach in terms of numbers that can be served.

Environmental and policy approaches are based on the concept that educational and motivational interventions will be more effective in social and physical environments where *healthful choices are the easier choices* (Swinburn et al., 1999).

- Physical issues – e.g., what is available and promoted, such as food choices in the home or school; exposure to and quality of TV advertising; opportunities or barriers to physical activity
- Economic issues – e.g., price of soda versus water, price of fatty meats vs. lean meats, price of fruits & vegetables, subsidies to sugar and corn producers
- Policy issues - e.g., rules about food service standards, regulations on marketing that targets young children
- Sociocultural issues – e.g., attitudes, perceptions, beliefs, and values such as fast food, everyday food, personal responsibility and the ethos of governments

Peters (2004) discusses the need to mount “a social change movement to create a future state in which healthy lifestyle behaviors are socially normative behavior” and to “provide people with better tools to support cognitive management of body weight within the prevailing environment” (p. 113). Elements which have been common across successful social change movements are:

- identifying specific issues, social and cultural values, and incentives and disincentives that are most salient to the audience in question (Daniels et al., 2005)
- identifying factors that will increase the probability that the individual or group will pay attention to, participate in, and be motivated by the change process (Daniels et al., 2005)
- identifying facilitators and barriers to change in the relevant structural and social environments and in the interactions among individuals, systems, and groups
- providing exposure to models and practical experiences with regard to the actions relevant to change (Daniel et al., 2005)
- building on a strong science base (Peters, 2004)
- finding a solution that is economically feasible and sensible (Peters, 2004)

Robinson, Patrick, Eng and Gustafson (1998) underscore the importance of an evidence base in “interactive health communication” (IHC) because of the possibility of doing harm as well as good. Their concern is expressed in the context of the increasing dissemination of information through mass media. “Planning of child obesity prevention programs should involve the program recipients, and all health education materials should be pre-tested to clearly identify the messages perceived among the target audience, and [to] prevent unintended and potentially harmful outcomes” (O’Dea, 2005, pg. 262).

“Education has been successful in making people aware of obesity as a health concern, and it has been effective in teaching them the principles of energy balance and the behaviors

needed to modify weight. Education has not been successful in changing population body weight" (Jeffrey & Utter, 2003, pg. 17S).

Children have demonstrated more success in weight loss and maintenance than adults (Epstein, Reommich & Raynor, 2001; Epstein, Valoski, Kalarchian & McCurley, 1995). "Targeted prevention in overweight and obese children was most successful when children were treated together with their parents" (Muller et al., 2001, p. S73). While noting that middle- and upper-class as well as intact families have been shown to benefit more from treatment [as opposed to prevention] than other families (citing Epstein et al., 1995-above), Muller et al. (2001) feel that children of obese parents of low social class should be targeted for prevention efforts. Efforts should include social support of individual families as well as education for children in schools (Muller et al., 2001).

Calfas et al. (1996) recognized the importance of social support and increased efficacy in improving levels of physical activity among their adult patients. They also determined the stage of readiness for change and customized the message to specific levels of readiness (Prochaska et al., 1994).

In a review of 92 behavioral interventions focused on dietary change, Ammerman, Lindquist, Lohr and Hersey (2002) found a stronger effect for intervention among individuals already at elevated risk for disease than among general, healthy populations. Small group interaction and goal setting were found to be effective components of these interventions.

Programs to address obesity prevention in children should include parents because they play a significant role in food consumed in the home and outside the home, food preferences, and exercise habits children develop in their early years. Parental habits greatly influence children's behaviors. However, "research on parent and family interventions has been hindered by the difficulty of getting parents to participate. Interventions targeting families have generally produced modest short-term effects on dietary behaviors but not on anthropometric measures" (Robinson & Killen, 2001, p. 264, citing Stolley & Fitzgibbon, 1997; Vega, et al., 1988).

Consistency in messages from the private and public sectors could be a significant factor in population-level prevention efforts. The development and promotion of low-fat food products paralleled health promotion messages. "The food industry spends in the neighborhood of \$50 per person per year to publicize food products. In contrast, the USDA spends about \$1.50 per person per year for all types of nutritional education" (Jeffery & Utter, 2003, pg. 15S, citing Gallo, 1999).

Wetter et al. (2001) provide a theoretical framework of the determinants of physical activity and eating behavior at the individual level that includes variables related to psychobiological, cultural and social factors. Behavioral skills that facilitate change are incorporated into the model. It is designed for applicability across the life span and is relevant to family-focused prevention efforts.

Interventions with children are typically based on behavioral theories designed to motivate and bring about behavioral change. Interventions on a broader scale should draw on theory at several levels (Kumanyika & Obarzanek, 2003).

- social and community change
- family functioning
- individual cognitive and behavioral processes

Daniels et al. (2005) suggest the following as the most desirable prevention goals:

- Primary prevention – preventing children at <85% from becoming at risk for overweight and preventing children >85% and <95% from becoming overweight.
- Secondary prevention – treatment of overweight children to reduce medical risks (such as type II diabetes), reduce the severity of the problem, and normalize weight if possible.
- Develop strategies tailored to children in ethnic minorities.

“Most primary prevention studies included one or more of the following components:

- dietary intake, aimed at reducing total energy intake
- nutrition/health education, intended to improve knowledge and behaviors related to food choices and to favor healthier lifestyles
- physical activity programs, aimed at increasing the time spent in moderate or vigorous activity, and/or reducing time spent in sedentary activities
- behavior modification and support, sometimes involving the family and/or members of the community” (Caballero, 2004, p. S591).

BMI is the most frequent outcome measure. Skinfolds or indices of body fat are used less often.

*Infancy* – Breastfeeding and the introduction of solid foods are primary issues.

- Promoting breastfeeding requires an understanding of the incentives and barriers influencing decisions in various subgroups and the policies which affect this behavior (e.g., breastfeeding discouraged in public places or workplaces). It is crucial to understand the cultural influences on feeding practices; e.g., differences in attitudes about breastfeeding between US-born and Caribbean- or African-born mothers (Daniels et al., 2005).
- “More parents and caregivers can benefit from guidance about the introduction of developmentally appropriate, micronutrient-rich first solid foods such as iron-rich infant cereals, iron-fortified grain products, meats, soft fruits, and cooked vegetables and the importance of breastfeeding through the first year of life. A smaller proportion of parents and caregivers require guidance on delaying the introduction of juices until six months of age and cow's milk other than formula until one year of age” (Briefel et al., 2004, p. S31).

Findings from the Feeding Infants and Toddlers Study (FITS) indicate that children's diets are greatly influenced by adult diets. Changes in children's diets will require changes in adult diets (Devaney, 2004, pp. 1157-1158)

- Mean intake of food exceeded the mean energy requirement by 10% for infants 4-6 months of age and by 31% for children 1 to 2 years old.
- By 6 months of age, 94% of infants were given solid foods.
- By age 2, about 1/3 of toddlers did not eat fruit and about 1/5 did not eat a vegetable on the day of the recall. French fried or fried potatoes are the vegetable most often reported. The percentage of deep yellow vegetables decreases dramatically as toddlers more frequently eat table food.
- Toddlers were consuming typically adult food. On the day of recall, 10% had candy, 23% consumed sodas or other sweetened beverages, 27% ate salty snacks, and 27% had hot dogs, sausages, or cold cuts.

**Early childhood** - This is an important time for preventive efforts "because of the rapid growth, development and learning taking place and because of adiposity rebound, adipocyte physiology and limited potential for reversing metabolic changes associated with overweight" (Daniels et al., 2005, p. ). Efforts should help families, teachers, and child care providers acquire skills to balance children's energy intake and output and to implement their knowledge in ways that motivate children to develop healthy behavior patterns.

- A reasonable goal for weight gains for preschool children is 2.5 lb./in. of growth. In the Healthy Start Preschool Study, this rate of gain at ages 3 and 4 resulted in children being at an appropriate weight at ages 8 and 9, whereas a gain of 5 lb./in. predicted overweight (Williams, Strobino, Bollella & Brotanek, 2004).
- Desired behaviors include increasing consumption of fruits, vegetables, and fiber-containing grain products, switching from full-fat to 1% or fat-free dairy products after 2 years of age; preparing and eating family meals at home; increasing daily physical activity such as active play for 1 hour/day; and limiting sedentary activity such as watching television to 2 hours/day or less.
- Among white middle-class children aged 3-5 years, modifiable risk factors such as dietary intake and physical activity accounted for more of the variance in BMI in a 3-year period than did nonmodifiable risk factors such as obese parents. Klesges, Klesges, Eck and Shelton (1995) concluded that encouragement of healthy diets and physical activity can decrease accelerated weight gain in preschool children. The researchers suggest that preventive intervention efforts "geared toward minimizing excessive weight gain could (and perhaps should) occur in children as young as 4 years of age" (p. 129).
- A randomized, controlled efficacy trial of the Hip-Hop to Health Jr. program for preschool minority (African American and Latino) children demonstrated success in reducing excessive weight gain in children at both Year 1 and Year 2 follow-ups (Fitzgibbon et al., 2005). The intervention was designed to prevent further excessive weight gain in overweight children and to prevent overweight in normal weight children by increasing healthy eating and exercise. Children in intervention schools participated in nutrition lessons and 40-minute exercise sessions 3 times a week for 14 weeks. Parents received weekly newsletters containing information that matched what the children were learning and a homework assignment that required 15-35 minutes per week. Parents received a \$5 grocery store coupon for every completed homework assignment. Parents also recorded their child's intake of fruits and vegetables each week. Control group children received a general health and

- safety program 20 minutes a week for 14 weeks, and their parents received a newsletter matched to this content. No information on diet or exercise was given to the control group. Approximately 88% of parents reported reading the newsletter, and 61% returned at least one homework assignment. At both the Year 1 and Year 2 follow-ups, intervention children had less increase in BMI, although mean weights were increasing as the children grew. Relative effects of the intervention at both the Year 1 and Year 2 follow-ups were the same for boys and girls, for children below and above the median age at baseline, and for children below and above the 85<sup>th</sup> percentile of BMI at baseline. The researchers note that because the intervention was designed for a low-income minority population, the results may not be generalizable. Delivery of the intervention by specially trained early childhood education teachers may have resulted in greater integrity in the implementation than would occur if presented by classroom teachers (Fitzgibbon et al., 2005).
- Enthusiastic teacher modeling and peer modeling of eating new foods have been shown to increase preschool children's willingness to try new foods (Hendy & Raudenbush, 2000).
  - A randomized controlled trial in 16 preschools and day care facilities with children aged 2.6 to 5.5 years demonstrated effectiveness in reducing television viewing among the intervention group, while hours per week of television watching increased in the control group. The percentage of children who watched television or videos 2 or more hours per day declined in the treatment group but increased in the control group. An early childhood teacher and a music teacher presented 7 sessions as part of the Brocodile the Crocodile health promotion program. Parents were involved in supporting children's alternate activities, turning off the TV at mealtime, and reporting on television time (Dennison, Russo, Burdick & Jenkins, 2004).

*Middle childhood and adolescence* – Most of the interventions for this age group have been conducted in schools. Although changes have been found in targeted behaviors, such as increased physical activity and improved dietary habits, there has been little success in changing weight or body fat. It has not been determined if these interventions have been too short or lifestyle changes within the school have not been carried over into students' other environments. Other potential reasons for lack of success are failure to correctly identify target behaviors for change, poor implementation of programs, and measurement issues.

Muller, Danielzik & Pust (2005) note that, because only two studies have addressed the confounding effect of gender and none has investigated SES effects, "the published effects of school-based interventions on nutritional status may have been camouflaged by the proportion of boys and SES groups within the study population" (p. 252). One study not included in Muller et al. (2005) did demonstrate positive effects with a low SES population (Foster et al., 2004, discussed below).

Below are a few successful interventions:

- Reduction in media use and the number of meals children ate in front of the television resulted in weight loss measured in several ways (Robinson, 1999). This program ran over a 6-month period and involved school, family, peer and cultural

influences and changed teacher behavior as well as student behavior. Although “there is insufficient causal evidence to definitively link [television] advertising directly with childhood obesity,” the success of this intervention suggests that it may be important to consider reducing exposure to media in prevention efforts at the population level (Daniels et al., 2005, p. 2006).

- Revision of physical education programs to include dancing (Flores, 1995) and endurance training (Dwyer et al., 1983) have resulted in reductions in weight and fat levels.
- In the Planet Health program, reductions in sedentary behavior, increases in vigorous physical activity, and nutrition education for middle school children resulted in obesity reduction among intervention girls but not boys. No improvements were seen in the control group (Gortmaker et al., 1999).
- Enhancing physical education classes, increasing other physical activity during the school day, and marketing low-fat choices in all food areas in the school resulted in declines in BMI for boys but not for girls but no reduction in fat intake for either boys or girls. This intervention targeted school policy in middle schools rather than direct student education about eating or physical activity (Sallis et al., 2003).
- Availability of vending machines and a la carte programs in schools has been positively associated with increased fat intake and decreased consumption of fruits and vegetables (Kubik, Lytle, Hannan, Perry & Story, 2003). When food prices were reduced and the availability of healthier foods increased in high school cafeterias and vending machines, students purchased more of the targeted foods and decreased fat intake (Story et al., 2002).
- A policy-driven intervention in elementary schools with a low-income population demonstrated that changes in nutrition standards, nutrition education and staff training within the existing curricula, and social marketing to change student behavior can positively affect risk for overweight. At the 1-year follow-up, a greater percentage of students who had been at risk for overweight at baseline were no longer at risk in the treatment condition than the control group, and there was a lower percentage of children in the treatment group who were not at risk for overweight at baseline but had become so than in the control group (Foster et al., 2004).

Although not an intervention, enrollment in an after-school program (ASP) has been found to be a “buffer against” a normative increase in BMI experienced by children not attending an ASP (Mahoney & Lord, 2005, p. 212). Among 439 children, most of whom were African-American or Hispanic and lived in poverty, 21% were obese at the time of the initial measurement (average age = 4.9). At follow-up (average age = 8.1), when baseline obesity, poverty status, and race and ethnicity were controlled, 21% of the children attending an ASP were obese compared to 33% of nonparticipants. Ways in which ASPs may contribute to child obesity prevention are (a) reduced time for sedentary activities and possible overeating, (b) engagement in pleasant activities rather than passive health education and a focus on giving up negative habits, and (c) continuation of afterschool activities into adolescence for children who are involved in their middle childhood years.

## Family-focused interventions

Principles of family-focused interventions have been summarized by Kumpfer and Alvarado (2003) and can be found by going to

<http://aq.udel.edu/extension/fam/professionalresources/parentEd/2005litreview.htm> .

Click on Evidence-based Programming under FULL VERSION and go to page 7 of that document. References are included at the end of the document.

From a review of 14 well-designed prevention studies published between 1993-2003, Bautista-Castano, Doreste and Serra-Majem (2004) concluded that parental involvement can help in effectiveness of interventions designed to reduce excessive weight gain and obesity in children. Observations from that review

- Interventions of 6 months to a year are more effective than shorter or longer ones.
- Interventions involving nutrition education together with the promotion of physical activity are more effective if they are combined with behavior modification.

Lumeng (2005) recommends that interventionists acknowledge the limits of parental influence in the face of an obesogenic environment which imposes a myriad of societal and biological influences on children's eating. A potentially productive direction is empowering parents to advocate for systemic change in child care, preschool settings, and after-school programs to promote (a) availability of healthy food in a pleasant atmosphere and (b) an increase in the amount of physical activity in which children engage because parents have less time and home environments may be less safe. Parents should also be motivated to work for safer playgrounds in their neighborhoods. These issues are particularly important for low-income families.

Parent education concerning obesity prevention should be provided for parents of children from birth to six years of age, regardless of the child's current weight. This is especially important if one or both parents are overweight. Ideally, this education would begin with the first prenatal visit to a doctor and be reinforced by other information providers (Sothorn, 2004).

Strauss & Knight (1999) recommend targeting changes in home environment, especially among younger, lower SES children. Cognitive stimulation level is amenable to change through parenting, whereas SES and parental obesity are much less so. The authors cite four parenting education programs which were effective in improving home environment, particularly among lower income families (Hamilton, 1972; Johnson, Breckenridge & McGowan, 1984; Metzel, 1980; Slater, 1986).

Improving parental nutrition knowledge is essential in preventing childhood obesity (Variyam, 2001). In this survey, BMI s were self-reported rather than measured by professionals and are thus more likely to be understated if inaccurate. An analysis of data from The Diet and Health Knowledge Survey (DHKS), a subset of the families participating in the Continuing Survey of Food Intakes by Individuals (CSFII) 1994-96, showed that

- About 20% of children whose parents had appropriate attitudes about diet and adequate nutrition knowledge were overweight.

- The percentage of children who were overweight was greater among parents who had less nutrition knowledge (e.g., weren't aware of health problems caused by not eating enough fiber or the recommended daily number of fruits) or who personally preferred diets that did not include the recommended number of fruits, vegetables or grains.
- The percentage of children who were overweight was also greater among parents who did not use nutrition labeling at least some of the time.

### **Cultural adaptations**

"Culturally specific programming tends to shift control to the client population and challenges providers to acknowledge their own personal and professional cultural concepts and biases. A fundamental issue is whether the social and familial relationships and cultural practices that define daily living in the client population are viewed as targets for change, as difficulties to be overcome, or as positive forces that can be leveraged in favor of the programmatic goals" (Daniels et al., 2005, p. 2006).

Maintaining the theoretical basis of the program is crucial when adapting programs to accommodate varying cultural beliefs and practices. Program developers must also be cognizant of age, gender, and generation variation within cultures and the "mainstream cultural forces such as media that are targeted differently to different demographic groups" (Daniels et al., 2005, p. 2006).

The belief system of a cultural group plays a significant role in attitudes about practices related to disease prevention (Wetter et al., 2001). Middle-class Americans generally accept the biomedical model in which dietary management and increased physical activity are the basis for illness prevention. In a naturalistic belief system, common in Asian cultures and some Latino cultures, people see correcting imbalances between opposing forces as a means of preventing illness. And in a personalistic belief system common among Haitians, Hmong, and some traditional African American and Native American groups, poor health is the result of an external agent. To succeed, health-related interventions must be geared to these considerably different perspectives (Wetter et al., 2001).

As an example, infant feeding patterns are strongly influenced by cultural beliefs and norms. Bentley et al. (1999) identified issues which are important in designing interventions with African American parents. Beliefs about the healthiness of a "big male" infant may result in overfeeding. Involving maternal grandmothers in education about feeding practices is crucial because they often make the decisions about feeding (Hannon et al., 2000). Very young mothers are dependent upon their mothers and generally acquiesce in their decisions. Support of grandmothers may be adaptive for the children and the adolescent mothers as they continue their own development. With these families, it is important to understand why solids are typically introduced so early, to offer solutions for infant crying and not sleeping through the night, and to clarify differences between adult and infant nutritional needs.

To promote knowledge about nutrition among Hispanic mothers of preschool children, *abuelas* (Hispanic grandmothers) were trained as educators because "their advice, opinion

and authority are honored in the Hispanic community, especially in the areas of family, health, nutrition, meal preparation, and the related financial resources" (Taylor, Serrano, Anderson & Kendall, 2000, p. 244). *La Cocina Saludable-The Healthy Kitchen* was based on the Stage of Change Model (Prochaska & DeClemente, 1983). Gains in knowledge found on pre- and post-tests indicated that the educator training was successful. At the 6-month follow-up, parent participants demonstrated retention of acquired knowledge and self-reported behavior change. In place of pre- and post-tests, participants suggested providing an opportunity to talk about what they had learned or using a game or meal preparation to display acquired skills.

Stolley and Fitzgibbon (1997) adapted the Know Your Body's Program for African-American mother-daughter pairs to test a way to reduce fat intake among both mothers and daughters. The foods used in changing recipes, planning meals and comparing high- and low-fat foods were identified from an earlier pilot study. The treatment used diet and exercise materials gathered from magazines geared toward African-Americans and incorporated relevant music and dance for some exercise and diet-related activities. Although mothers in the treatment group reported more change in their diets than their daughters, the researchers posited that, if mothers continued the dietary changes, daughters' fat intake might also decline.

Flores (1995) used aerobic dance as a strategy for physical activity which appealed to African American and Hispanic adolescents.

### **Community intervention**

A small community-level intervention to encourage goal setting for nutrition and to increase physical activity level and knowledge about physical activity demonstrated positive outcomes with families, but not with students (6<sup>th</sup> and 7<sup>th</sup> graders). Families made significant shifts in their readiness for change in the areas of exercise and healthy eating. The program was conducted in three phases over a year to increase awareness of obesity in youth and was developmentally appropriate for the students (Hawley, Beckman & Bishop, 2004).

### **Potential negative effects of obesity prevention programs**

Seeking preventive approaches for children "requires additional efforts to avoid any adverse effects on those children who are not obese or those who have a higher risk for undernutrition" (Caballero, 2004, pg. 591).

Well meaning efforts to prevent obesity may unintentionally

- create body image issues even for youth who are not overweight (O'Dea, 2005)
- result in unsupervised weight control attempts which interfere with proper development by limiting energy intake, engaging in vomiting and use of laxatives, and adopting "quick fix" diets and fads (O'Dea, 2005)
- further stigmatize overweight children (Latner & Stunkard, 2003; Strauss & Pollack, 2003)
- result in avoidance of health care visits (O'Dea, 2005)

- leave overweight people and unsuccessful dieters feeling like failures (O'Dea, 2005)
- further victimize low SES parents and children

Interventionists are reminded to “focus on habits rather than focusing on habitus to avoid stigmatizing the child, adolescent, or family” (AAP, 2003, pg. 426). Approaches to families should be made in a non-judgmental, blame-free manner so that an unintended negative impact on self-concept is avoided (Davison & Birch, 2001).

Highlighting the problems of obesity may make overweight children more self-conscious about their weight and physical ability (O'Dea & Abraham, 1999). Rather than coercing children into activities which make them uncomfortable (e.g., lack of skill, lack of privacy in dressing rooms), helping children and adolescents discover and engage in physical activities that they enjoy increases self-esteem, enhances social interaction, and may promote friendships (Strauss & Pollack, 2003). Blair (2003) points out that fat children can be fit and healthy.

## **RECOMMENDATIONS**

### **General recommendations**

- Promote consumer education to reduce portion size and responsible action by the restaurant industry to reduce portion sizes, especially of high-energy density foods (Hill & Peters, 1998).
- Increase availability and affordability of foods that are low in fat and energy-density like fruits and vegetables in stores and restaurants. It is unlikely that people will change their diets, given the current food supply, unless low-energy foods that taste as good as high-energy foods are available (Hill & Peters, 1998).
- Consider the need for regulating or curtailing advertising and promotion of energy-dense, nutrient-poor food products to children (Institute of Medicine, 2005).
- Collaborate with professionals in the fields of nutrition, behavioral health, physical therapy, and exercise physiology.
- Encourage funders, including insurers, to support preventive and treatment efforts.

### **Recommendations for school-level intervention**

- Discourage use of vending machines, snack bars, and school stores for school revenue. Discourage availability of carbonated beverages in schools (Ludwig, Peterson & Gortmaker, 2001). Encourage schools which have contracts for sale of soft drinks in the school to modify them to reduce student consumption (American Academy of Pediatrics, Committee on School Health, 2004).
- Encourage teachers and coaches to discuss health habits, not habitus.
- Advocate for physical education and daily physical activity for all youth rather than a few teams. A panel of health experts reviewed 850 articles to evaluate evidence on the influence of physical activity on several health and behavioral outcomes in youth 6-18 years of age. They concluded that “School-age youth should participate daily in 60 minutes or more of vigorous physical activity that is developmentally appropriate, enjoyable, and involves a variety of activities” (Strong et al., 2005, p.

732). The 60 minutes could be achieved by engaging in physical activity in physical education classes, intramural sports, recess, before- and after-school programs, and similar endeavors. Of special concern is the decline in physical activity during adolescence. Youth who have been physically inactive should be encouraged to increase their level of physical activity by about 10% per week until they have reached the 60-minute goal. This panel identified two “excellent sources” of guidelines for the promotion of physical activity among youth:

- National Association for Sport and Physical Education - Guidelines for birth to 5 years and for 6-12 years can be accessed at [http://www.aahperd.org/naspe/template.cfm?template=ns\\_index.html](http://www.aahperd.org/naspe/template.cfm?template=ns_index.html)
- U. S. Centers for Disease Control and Prevention – Guidelines for school and community programs to promote lifelong physical activity among young people can be accessed at <http://www.cdc.gov/mmwr/PDF/RR/RR4606.pdf> .
- Use the school environment to educate parents about the negative effects of sedentary behaviors at home (TV, computer games) and the positive benefits of nutritious eating (Sothorn, 2004).

**Recommendations for parents [see Key Messages for Parents for specific recommendations for working with parents]**

“Parents are key role models for their children. Like their children, parents are also twice as likely to be obese today as they were 30 years ago, even though genetic susceptibility has not changed over this time. This means that children of today are more likely to observe their parents model eating and activity behaviors that do not promote energy balance (for example, consuming larger portions and watching more television).....The major challenge in dealing with these facts about the ‘nature’ and ‘nurture’ components of obesity is that parents are understandably alienated by messages that place blame and responsibility on them for their children becoming obese or for adopting behaviors that can lead to obesity. Instead, parents desire constructive, achievable solutions that are communicated in a positive tone and that recognize the constraints of their larger environment and life circumstances” (Whitaker, 2004b, p.21).

**Recommendations for community-level intervention**

- Address issues of the physical environment, urban planning and transportation that provide low SES families with more opportunity for safe and enjoyable physical activity (Powell, Bricker & Blair, 2002). In areas of busy traffic, advocate for traffic-calming measures such as speed bumps to improve pedestrian safety (Timperio et al., 2005).
- Advocate for health- and fitness-promoting programs and policies.
- Promote community gardens and farmers’ market projects.
- Support social marketing intended to promote healthful food choices and increased physical activity

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