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RESEARCH ARTICLE

DIETARY CAUSES OF CHILDHOOD OBESITY

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ABSTRACT

Childhood is an important developmental stage in the lifecycle. It is the age of rapid growth. These years are critical for a child as what happens at this age has an impact on adult life. It is well established that food habits inculcated in childhood can last a lifetime. Overweight and obesity in children is rising all over the world and its causes are constantly in discussion. Overweight/obesity has several causes-genetics, environmental factors which include diet and activity behavior. Multiple causes contribute to the development of obesity in children and no single factor is solely responsible. With the changes in dietary patterns, diets are nutritionally poor resulting in reduced consumption of vital nutrients and a high consumption of fats, sugar and salt. This paper aimed to note the dietary causes of overweight and obesity in children. Some of the causes discussed herein include feeding practices, availability of food and increased consumption of processed food. Television viewing, food advertisements, skipping breakfast and even nutrition knowledge of parents and children are briefly discussed.

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INTRODUCTION

Nutrition and eating habits are central to good health. It is well established that food habits inculcated in childhood can last a life time and nutritional status of childhood plays an important role in determining adult health and disease (Corbin *et al.*, 2000). Today, food is an indicator of lifestyle and pleasure rather than a necessity for nourishment. Dietary patterns have changed due to socio economic transition particularly in the developing countries. The consumption of vital nutrients has reduced and that of fats, sugar and salt has increased. Thus in addition to underweight, incidence of overweight and obesity has increased and it has become the focus of attention. These conditions are due to nutritionally poor diets and reduced physical activity levels (Schmidhuber and Shetty, 2004; Lukito and Wahlqvist, 2006). In Asia, overweight and obesity started to rise as incomes increased and lifestyles changed. Food was the first "investment" for good health of children. In China extra love and care for the only child was manifest through food and the rate of overweight and obesity has increased there (Schmidhuber and Shetty, 2004).

Energy Metabolism and Obesity

Energy intake is defined as the caloric content of food as provided by carbohydrate (4 kcal/g), protein (4 kcal/g) and fat (9 kcal/g).

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The energy that is consumed through food is required by the body for cellular, metabolic, and mechanical activities for example breathing, beating of the heart and muscular work. The energy that is consumed in the form of food is stored in the body in the form of fat, glycogen or protein. These stores are used by the body as fuel whenever energy is required (Wabitsch, 2008). When energy intake is lesser than energy expenditure it is called a state of negative energy balance. Energy balance occurs when the intake of energy matches the amount of energy expended. When energy intake exceeds expenditure the body is in positive energy balance. Excessive feeding or overfeeding leads to positive energy balance and can also result in increased energy stores. This energy imbalance over a long period of time can lead to obesity (Gopalan, 1998). A high calorie intake in childhood may be related to an increased risk of non-communicable diseases in later life (James, 2004; Bleich *et al.*, 2011).

Urbanization and globalization are responsible for the lifestyle changes seen all over the world. The dietary changes due to urbanization include:

- More consumption of convenience foods against home cooked traditional meals because of more number of women working.
- Increased availability of fast foods, convenience foods that tend to be high in fat, sugars, salt as well as varying cuisines from different countries.
- Reduced intake of fruits, vegetables, and therefore fiber.

- Poor consumption of pulses and roots and tubers.
- Improper labeling of food. For example labels may indicate the food to be low in fat. However, that food may actually be higher in calories.
- More foods are being refined and consumed.
- Use of additives and preservatives including salt and sugar has increased in many foods.
- Milk consumption is replaced with fruit juices or soft drinks (Nishida and Mucarele, 2004).

Hence, this paper attempts to review the dietary causes of childhood obesity.

Various dietary causes of obesity are summarized herein-

a) Maternal Feeding Practices: Mothers prefer plump children as it is a sign of being healthy. Parents often believe that fatness is temporary and will soon vanish as the child grows (Bhave *et al.*, 2004). Breast feeding is said to be protective against the development of obesity (Labbok, 2004). Leise *et al.*, (2001) conducted a study in Germany on over 2000 children. They reported a significantly lower prevalence of obesity in breast fed children against bottle fed children. Also a decreasing prevalence of overweight was associated with longer duration of breast feeding. However, this has not been consistently reported by all investigators. Some authors have reported no association with breast feeding alone as a cause of obesity (Herring and Oken, 2010). Bottle-feeding may cause overfeeding as a child may consume more milk compared to a breast-fed infant (Mohanty, 2008). Many a times, babies are forced to finish the bottle feed. This causes not only increased intake of calories but also protein. Such “early-onset obesity” may develop more in childhood (Wabitsch, 2008). Childhood is a period of developing food preferences, dietary patterns and even activity patterns (Birch and Davison, 2001). Children’s eating behaviors are influenced by parent’s food choices and parenting practices. Several mothers force-feed large quantities of food, which cause higher energy intakes. Mothers who feed excess energy may set off early beginning of obesity. Some children have more fat cells. If such children are overfed, hypertrophy of fat cells can occur (Ronizio, 1997). Some mothers restrict foods, hence those foods become attractive to children and may tempt them to consume such foods in large quantities when permitted. They may also sneak the foods and eat them. It may result in the child consuming high energy foods (Braun *et al.*, 2003). Food is also used as a reward for children and the reward is usually a sweet food. Blisset *et al.*, (2010) conducted a study on 3 to 5 year old children and found that children whose mothers used food to regulate emotions ate more cookies and chocolates even when they were not hungry. Improper feeding habits are associated with overweight. Parents should promote consumption of fruits and vegetables and should also keep a supply of these foods (Nicklas *et al.*, 2001). Fruits and vegetables being perishable foods, if not regularly supplied lose their place as snack items and are likely to be replaced by snacks that are usually highly flavored and attractively packed. Parents can be good role models of eating behaviors. When parents ate fruits and vegetables, children also reported a high intake of these foods and low intake of fats and sugars.

b) High Energy Intake: The energy density of foods depends on their sugar, fat and/ water content. Consumption of large amounts of fats and sugars increases the energy supplied

by the diet whereas inclusion of fruits and vegetables reduces the energy content (Drewnowski *et al.*, 2004). A report by the World health Organisation (2002) indicated that consumption of high energy density foods is associated with the rising rate of obesity. A high carbohydrate diet particularly when it contains refined foods and a high fat intake leads to excess energy intake. Intake of sugar should be in moderation. Processed foods contain sugar and therefore increase sugar intakes unknowingly. Frozen, canned and preserved foods all contain some sugar. Breads, breakfast cereals, soft drinks, cakes, pastries and chocolates are major contributors of sugar in the diet. On the other hand dietary fiber is one carbohydrate that can reduce dietary energy. In recent years, consumption of whole grains has reduced and refined foods have increased in the daily diet. Traditional foods are being replaced with junk food rich in fat, sugar, sodium and preservatives (Parizkova *et al.*, 2007). Fibre intake has reduced. The link between high fat diets and obesity is well documented (Duyff, 2006). Over a period of ten years, there has been an increase in the percentage of energy from fat and simple sugars in Chinese diets, particularly saturated fat. This change has been observed in urban and rural areas and it is said to be due to an easy availability of a wide variety of foods (Parizkova *et al.*, 2007). In a study of 8 to 11 year old children, it was observed that boys consumed a larger amount of food and had higher energy intakes than girls in the pubertal period. In boys the greater energy intake was during late puberty whereas in girls a greater energy intake was seen in the mid puberty period (Shoemaker *et al.*, 2010). In the traditional Indian diet, refined cereals have taken the place of whole grains and millets leading to a reduction of fiber, B complex vitamin and other micronutrients in the diet. With a decrease in cereal intake, the intake of sugar and fats has increased. Fast foods and convenience foods have found easy acceptance (Gopalan, 1998). Fat intake is also responsible for the increase in pediatric obesity (Kapur and Sethi, 2003). Addleman (1992) reported a positive relationship between fat intake and adiposity in children. Children with a higher percentage of body fat or BMI were observed to report a greater preference for fat (Ronizio, 1997). On the other hand a high intake of dark green leafy vegetables and deep yellow vegetables was associated with a lower fat mass in children. High intake of fried food and processed meat was associated with high body fat in 3 to 8 year old children (Wosje *et al.*, 2010).

c) Consumption of High Fat and High Sugar Foods: Such foods therefore play an important role in childhood obesity. Consumers have come closer to processed foods today compared to even a year ago. The rush to a new fast food joint tells of the popularity of these foods. Fast foods are often low in essential nutrients and high in fat. High energy fast foods may also have a high glycemic index because of the high amount of sugar in them (Bowman *et al.*, 2004). Children’s food habits have gradually changed from eating traditional foods to convenience foods. Earlier this change was only in snacks but more recently, convenience foods have begun to replace meals (Sharma, 1998). Food tastes are changing and taste influences food choices in all age groups. Fast foods, which match the fast pace of life, are preferred. Foods like pizzas, burgers, noodles, deserts and many such foods are replacing home cooked meals in the diet of children. Fast foods or junk foods are usually deep fried with less other nutrients value. They are high in energy, carbohydrate and saturated fat, lacking in fibre and trace elements, (Kapur and Sethi, 2003). Fast food outlets are extremely popular with

children and adolescents. This age group views fast food places as meeting places for friends. A study in Nepal on school children observed increased intake of ready to eat foods like biscuits, potato chips, doughnuts and other local fried snacks (Sharma, 1998). A study on 10 year old children reported that consumption of foods like soft drinks, flavored drinks, sweets, candy and meats had a positive association with overweight. Also total amount of food and snacks consumed by them was significantly and positively associated with overweight (Nicklas *et al.*, 2001). Increased consumption of sugar, salt, soft drinks, chocolates, mithais and a reduced consumption of cereals, vegetables and fruits was observed in a survey conducted on thirty five households in Mumbai (Udipi, 2011). The same survey also reported that children generally demanded junk food like pizza, burger and Frankie as well as chocolates. Colas, sweetened fruit juices, squashes are empty calorie drinks and have replaced milk in a child's diet and have been linked to obesity and type II diabetes in children (Addleman, 1992). Colas contain no other nutrients and has only calories and so is said to be 'empty calories'. The consumption of cola drinks has been observed to be usually accompanied by fried snacks or fast foods (Katz, 2011).

d) Food Accessibility: A changing environment has broadened food options. The coming up of convenience food stores near the house has affected selection of food. These stores stock their shelves with a greater selection of pre-packaged foods, fast foods and soft drinks. This has affected the choice of people in the low socio economic group who may not afford fresh fruits and vegetables and therefore choose cheap foods which may actually be high in fat, sugar, and calories (Duyff, 2006).

e) Skipping Breakfast: Skipping breakfast increases the risk of obesity (Tsakalu *et al.*, 2004; Tin *et al.*, 2011). A steady decline in breakfast consumption along with a rising incidence of obesity has been seen in recent years. Skipping breakfast affects learning and school performance of children. Children who eat breakfast are more likely to meet their nutritional needs of micronutrients (ADA, 2008). Skipping breakfast makes a person eat more food later and often the wrong foods during the rest of the day (Siega-Riz *et al.*, 1998; Story and Sztainer, 2002). A high waist circumference and waist to hip ratio were found to be correlated with irregular breakfast habits in 9-11 year old children from Finland (Lehto *et al.*, 2011). Children who skip breakfast consume higher amounts of fat and those who have a regular breakfast consume less fat, was reported in a study from USA. Omitting breakfast has been associated with significantly higher fasting total and LDL cholesterol (Hamid *et al.*, 2005). It was seen that girls skipped breakfast more than boys. In Fiji, McCormick *et al.*, (2010) reported 68% girls to be skipping breakfast and also 25% overweight and 15% obese. In UAE, 37% girls and 28% boys between 6-7 years skipped breakfast. Thus it has been suggested that eating breakfast regularly help prevent overweight and obesity in children (Musaiger, 2011).

f) Low Consumption of Dairy Foods: There is evidence that increasing dairy intake by about two servings per day could reduce the risk of overweight by up to 70%. In addition, higher calcium intake was associated with 21% reduced risk of development of insulin resistance that could reduce diabetes risk among overweight younger adults. Higher calcium intake and more servings of dairy foods per day were associated with reduced adiposity in children studied

longitudinally (Bressan *et al.*, 2007). Researchers have reported that low intakes of dairy foods may be associated with higher body fat in childhood. Children who consumed the fewest servings of dairy per day had statistically greater gains in BMI and body fat than those who consumed more servings (Moore *et al.*, 2003; Albertson *et al.*, 2003; Barba *et al.*, 2005). A high dairy food consumption was associated with a low percentage of body fat by Skinner *et al.*, (2003); Novotny *et al.*, (2004) and Lappe *et al.*, (2004). There was a significant association between obesity and low intake of dairy foods in a study conducted by Olivares *et al.*, (2004). Thus, dairy foods have been considered protective against obesity.

g) Television Viewing and Food Advertising: In the present day, children are surrounded by several forms of media that includes Television, FM radio, print media, videos, endless high speed internet and web sites. All these are blamed for more sedentary lifestyles. Persons of all ages but particularly children and adolescents rely on television and internet for entertainment. The duration of viewing TV has been associated with obesity and poor fitness levels. This simply is due to reduced physical activity and a high possibility of a high energy intake due to snacking while watching TV. The same has happened with video games (Swinburn and Shelly, 2008). The authors suggested that it is difficult or almost impossible to prevent TV viewing and only remedy is the control of consumption of energy rich foods and soft drinks due to the aggressive advertisements on TV. The World Health Organization (2003) has stated that TV advertising influences the food purchases of children. Massive advertising of high calorie, low nutrient fast food was reported to increase the risk of childhood obesity. A study conducted on food commercials in USA, reported that more than 80% of the advertisements were for children and the foods at were advertised included snacks, fast foods or sweets (Harrison and Marske, 2005). The influence of marketing and brand names has been effectively demonstrated by Robinson *et al.*, (2007). They offered the same food as McDonald's to two groups of preschoolers; one with the Mc Donald wrap and the other simply wrapped. More than 50% children preferred the food with Mc Donald wrap, as they thought that it was from Mc Donald's. Advertisements also promote a high calorie intake (Story, 2002). A lot of food advertisements are targeted at young vulnerable age groups. Their influence is obvious from the demands of children who desire high caloric junk food frequently. Today advertisements of packaged and processed foods attract consumers. Healthy foods like fruits and vegetables are never advertised. Food selection is influenced by advertising, convenience and taste. Some foods are marketed as healthy, low fat, or fat-free, but may contain more calories than the fat containing food they are designed to replace (Duyff, 2006). Children and adults both have responded to aggressive food marketing and the convenience of eating out. More than a decade ago, in America food companies spent 75 percent and fast-food restaurants spend 95 percent of their advertising allocation on TV advertisements (Gallo, 1999). Television is the favorite advertising medium used by the food industry. For example, fast-food restaurants spent more than 95% of their advertising budgets on television advertisements. Exposure to food advertising-especially commercials for fast food, convenient foods, and soft drinks-may influence viewer's food choices towards higher-fat or higher energy foods. It is said that obesity can be prevented by restricting television viewing. It has been suggested that reducing the number of food related advertisements can be one

strategy to reduce incidence of obesity (ADA, 2008). There is evidence of a strong association between TV advertisements of food and children's food selection. Food preferences of children are highly influenced by TV advertisements (Patrie *et al.*, 2003). A study conducted by Fitzgibbon (2006), showed that advertisements influenced the food preferences in children. Children choose fast foods or even elected to eat out due to the advertisements. The demand for high calorie, low nutrient foods is high in children of higher weights after seeing the advertisements on TV (Matheson, 2004). The more the duration of TV viewing, higher were the intakes of total fat, saturated fat, energy and protein (Abbot *et al.*, 2003). A restriction on TV watching television by the elders in the family or parents may help prevent obesity has been suggested by Oliver *et al.*, (2010). In India, the popularity of television, radio, movies, computer and internet and mobile phones has increased immensely. Abbot *et al.*, (2003) studied 2000 children to investigate the relationship between TV viewing, diet quality and physical activity. The group that viewed TV for four hours or more per day had higher intakes of total fat, saturated fat, energy and protein above the recommended dietary intakes (RDI). Patrie *et al.*, (2003) reported findings that imply that children between 8-10 years have already established their food preferences due to TV viewing. The effects of TV advertisements on nutrition knowledge and attitudes are a cause for concern particularly due to the association between TV viewing and adiposity. Marshall *et al.*, (2003) reported girls who had low fat mass were vigorously active and watched less TV.

h) Nutrition Knowledge of Mothers and Children: Nutrition knowledge of mothers influences child feeding practices. Improper knowledge leaves out foods rich in essential nutrients and includes foods convenient to cook. Low and medium education of mothers was associated with obesity among rural children (Moraeus, 2005). Nutrition knowledge of children also matters. Hellems *et al.*, (2003) assessed nutrition knowledge and habits of 1144, 3rd to 8th grade students. Children scored poorly on nutrition knowledge questions. Children who identified low fat foods were likely to choose low fat foods for a week. Most children failed to meet the nutritional guidelines. Those who answered nutrition questions correctly were more likely to report healthier eating habits. Singhal *et al.*, (2010) reported a significant improvement in the nutrition knowledge of children in their intervention study. They also reported the intervention group to have a lower consumption of aerated drinks and energy dense foods along with a proper packed lunch and an increased fruit intake.

i) Portion sizes: Portion sizes have changed. People are eating more during a meal or snack because of larger portion sizes of the fast foods. This results in increased calorie consumption (ADA, 2008). Children are highly susceptible to food cues. A large serving attracts children. A meal or snack may be larger than actually needed by the body as the portion served is big. This is one of the causes of obesity in children (Duyff, 2006).

j) Income: Income level is linked to physical activity as well as food consumption pattern. Higher income groups have better facilities for physical activity. Low income group families may face a lack of places for physical activity and access to healthy food like fruits and vegetables. Therefore low income group children may spend more time in watching TV (James, 2004). Children and adolescents of lower

socioeconomic status have been reported to be less likely to eat fruits and vegetables and to have a higher intake of total and saturated fat (Fitzgibbon and Stolley, 2006).

k) Meal patterns: Recent research has shown that the eating two or three large meals per day is more likely to result in excessive fattening than five or six smaller meals, even when the amounts and types of foods eaten are the same for the two different meal patterns (ADA, 2008). Midnight snacking has also increased.

l) Eating in response to external cues: Many people are literally conditioned to eat, whether they require food or not, in response to such cues as the sight and smell of food, social gatherings, or while viewing movies or television. Hence, these people are likely to overeat and become obese if they are regularly exposed to these cues. A tendency to overindulge in eating desserts and sweets when lonely or depressed may be established in childhood by parents and relatives who used these foods as rewards or tokens of affection (Addleman, 1994). A joint effort needs to be made by parents, family and schools to make lifestyle and the environment non 'obesogenic' to protect the future generations from obesity and related health problems.

Role of schools

Schools are important as many food choices are formed here. Children spend a lot of time in school and so a large part of their daily intake happens in this setting. Not only the food choices but also eating patterns, physical activity behavior and nutrition knowledge is influenced by school. Therefore schools should promote healthy food behaviors. Instead, schools provide easy access to fast foods. Chips, soft drinks, chocolates and candy are sold in every school. In developed countries, vending machines in school are common and are sponsored by fast food establishments. Schools are also a prey to advertisement funds and so frequently, advertisements of food companies are seen in school. School buses also carry these advertisements. Teachers and peers have an important role in influencing eating behaviours in children. To prevent the increase in prevalence of obesity in children schools can contribute by having a policy of nutrition education. They should supply and serve healthy food. Also training the staff for preparation of nutritious food would be good. Avoiding advertising or promoting junk foods in school will also help (Sharma, 1998).

Role of Family

Children learn eating and physical activity behaviors from parents. Dietary habits depend on foods eaten at home. Due to the fast pace of life, busy routines and women working, more and more families are eating out. Sen (2006) reported that those children who ate at least three meals per week with their family had decreased odds of becoming overweight and those who were overweight initially and ate seven meals per week with their family had increased odds of losing weight.

Role of neighborhood and community

The neighborhood mainly affects physical activity behaviours. The availability of parks, clubs and recreation facilities influence physical activity. Children in the low-income group may not have such places for play (Birch and Davidson, 2001).

Physical activity of people also depends on their environment. A person may choose to avoid walking due to a lack of pavement. Communities and workplaces too influence people's health decisions. Cultural differences are seen in eating patterns of families. Food is an important part of religious functions and weddings. At such functions people are served much more food than necessary. Therefore it is important to provide environments which encourage physical activity and a healthy diet.

Conclusion

Dietary intake and nutritional status influence good health and well-being. Therefore a nutritious balanced intake of foods is necessary. Fruits, vegetables and whole grains supply necessary micronutrients and promote growth. Eating these foods and avoiding high fat, high sugar food is important for good health. Also, foods may lose one or more micronutrients due to processing and so processed foods should be avoided as much as possible. 'Instant foods' have taken a place in the kitchen to save cooking time. These foods are usually high in fat/ sugar, low in fiber and contain preservatives. A suggestion has been made to tax foods such as soft drinks, confectionery and snack foods so that it may discourage their consumption and sales may be lower (Fletcher, 2010). Such an initiative will surely help arrest the rising problem of obesity. Some do's and don'ts for healthy eating are-

Dos

- Teach children to eat when hungry.
- Introduce a variety of tastes to help them like all foods.
- Give healthy snacks and limit eating junk foods.
- Inculcate the habit of family meals.
- Give plenty of fruits, vegetables, and whole-grain breads and cereals.
- Give protein rich foods like fish, eggs and milk.
- Give water and juices and not soft drinks.
- Give fast food occasionally so that they eat healthy food most of the time.

Don'ts

- Do not give a sweet food as reward.
- Prevent food from being incentives for actions.
- Never force children to eat more than what they want.
- Prevent them from eating in front of the TV.

A nutritious diet in childhood will promote good health of children by helping them to maintain normal weight. It will also help develop healthy eating habits in children.

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