

DIETARY HABITS AND LIFESTYLE FACTORS ASSOCIATED WITH ADOLESCENT OBESITY: A REVIEW

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ABSTRACT

Obesity is one of the most alarming health problems of the millennium and it is not only restricted to the adult population, but also affects the children and adolescents too, in and around the developed countries. As obesity in adolescents is a major prediction of the onset of obesity in adults, further leading to various other chronic non-communicable diseases. Identification of the factors causing obesity is very important. Although genetic predisposition, is an important influencing factor, major focus needs to be given on the modifiable risk factors; in this regard, unhealthy dietary habits and physically inactive lifestyle, especially from adolescence needs to be addressed with an urgent intervention. Present paper reviewed the dietary habits and lifestyle factors, associated with obesity in adolescence.

KEYWORDS: Disease of Affluence, Socio-Economic Status, Dietary Habit, Indian Classical Dancing & Psycho-Social Benefits

INTRODUCTION

Overweight and obesity, are the causes for the fifth leading cause of, global deaths (Maessen *et al* 2014). It is the major determinant of deaths and the global burden of chronic non-communicable diseases, namely insulin resistance, dyslipidaemia, hypertension and other cardiovascular diseases (Bouchi *et al* 2016). Recently, obesity associated with its health problems are increasing worldwide including low and middle income countries (Little *et al* 2016). In 2010, the World Obesity Federation estimated that, over one billion adults were overweight and 475 million were obese, globally (Little *et al* 2016). The majority of which, resided in the developing countries of Latin America, Africa, and Asia. The reason behind the obesity epidemic is complex but, modern lifestyles that allow frequent intake of energy dense fast food and avoidance of physical activity are thought to have played major roles (Healy *et al* 2008). Another important area for consideration is, involving prolonged periods of inactivity and absence of whole body movement, which are distinctly related to risk of chronic diseases. In addition to the effects of total sedentary time, the manner in which it is accumulated may also be important. Single bouts of prolonged inactivity can cause, worsening of the obesity conditions, leading to the other metabolic diseases. Although extreme prolonged sedentary behavior is rare, in free living healthy adults, the technological and social factors have made prolonged sitting ubiquitous during working, domestic, and recreational time. The impact is quiet visible across all gender, age and ethnic groups. Weight gain, which has long been a feature of middle age and older adults, is now occurring much earlier in the life span, reflecting increased exposure to high-calorie diets and physical inactivity from early phases of life. With the increase in the prevalence and severity of overweight in adults, there

is an increasing tendency of obese people in association with a variety of physical, social and psychological consequence, wherein children and adolescents are becoming “one of the most serious public health challenges of the 21st century” (Roura *et al* 2016). The word ‘adolescence’ is derived from the Latin verb ‘*adolescere*’, which means “grow to maturity.” Adolescence is a grey area in the spectrum of life, falling between childhood and adulthood. It is an age of transition, when an individual experiences rapid growth and development, both physical and psychological, to attain adulthood (Kotecha *et al* 2013). As adolescence represents an important life stage, for the development of healthy nutrition behaviors, the nutritional demands associated with rapid physical and cognitive development and maturation are substantial. Recognized as a period of rapid body growth and development, with concomitant changes in body composition, insulin sensitivity and adipokine levels, as well as dietary habits and physical activity patterns, during the adolescent years, i.e. age-group of 10 to 19 years, represents a critical stage, for the risk of obesity, which is associated with both immediate and long term health implications. For the long-term health risks, studies have consistently demonstrated that, compared to obesity in early childhood, obesity in adolescence is a stronger predictor of adult obesity. Although an obese 4-year-old child has a 20% chance of becoming an obese adult, the likelihood, that obesity in adolescence would persist into adulthood, has increased to 80%. Adolescent obesity has also been reported to predict, a broad range of adverse health effects in adulthood, including type 2 diabetes, CVD and certain types of cancer, in addition to psychological disturbances (Krebs *et al* 2003, Park *et al* 2012). It is therefore critical to reduce obesity in this age group, to arrest the development of non-communicable diseases. The prevalence of overweight adolescents in the United States, aged 12 to 19 years has increased from 10.5% in 1988–1994 to 15.5% in 1999–2000 (Ogden *et al* 2002). A similar trend has been observed in Malaysia, where the prevalence of overweight adolescents has risen from 9.5% in 1997 to 19.6% in 2007. A relatively recent study has shown that, the prevalence of obesity in adolescents, aged 13 years was 23.9%, suggesting that almost 1 in 4 adolescents, are overweight or obese (Hazreen *et al* 2014). The increasing obesity epidemic has particularly, a detrimental effect on cardio-metabolic health in children and adolescents. A meta-analysis showed that, obese children had a higher risk of an adverse cardio-metabolic profile, compared to normal weight children (Friedemann *et al* 2012). Although increasing attention is being paid to the genetic contribution to obesity, a vast majority of studies have examined and reported, on the association between increased adiposity and environmental and behavioral factors, including diet, lifestyle and physical activity. As diet and physical activities are established as modifiable factors for prevention of obesity, these two factors should be addressed right from childhood. But, there is a little control over the food supply in schools, including canteens, and outside vendors who mainly provide energy dense snacks and drinks. A dietary behavior could be a priority for intervention because, it is known to be ‘Obesogenic’ and it has a high frequency in the population. Likewise, sufficient physical activity is associated with substantial health benefits, in young people that can track into adulthood (Janssen *et al* 2010). Yet, an astounding majority of adolescents, in both the developed and developing countries do not meet the health related guidelines of engaging in at least 60 minutes of moderate-to vigorous- physical activity (MVPA) everyday (Guthold *et al* 2010). Despite, the complex etiology of obesity, studies report that many researchers assert that, the main cause of obesity is an energy imbalance between calories consumed and calories expended. Moreover, the WHO has observed a global shift in dietary preferences, towards energy-dense foods that are higher in fats and sugars, yet poorer in vitamins and minerals. In addition to it, the increasing trend of decreased physical activity level, which is due to the rise of sedentary lifestyles (National Coordinating Committee on Food and Nutrition 2013), has worsened the obesity problem for adolescent individuals. Excessive time spent in sedentary behavior, especially screen-based sedentary behavior, has emerged as another important, modifiable risk factor (Tremblay *et al* 2011). Present review work, in this backdrop, has been

undertaken to get an idea of the present scenario of major dietary habits and lifestyle factors, associated with obesity in adolescents.

METHODS

Electronic databases were searched, based on select key elements- adolescence, dietary habits, types of sedentary behavior, screen time and like. In addition to the above, the reference lists was made from articles related to the above mentioned list.

FINDINGS

The etiology of childhood obesity is complex and multi-factorial, which includes a myriad of behavioral, intra-personal and social-environmental risk and protective factors. A study by Bahreynian *et al* was conducted on 637 elementary school-aged Iranian children, to determine the association between major dietary patterns and overweight/obesity among them. It has been found that; healthy pattern was related to weight status of school boys (Bahreynian *et al* 2013). A study was conducted in Lebanon, to identify and characterize dietary patterns, to investigate the association of these patterns with socio-demographic and lifestyle characteristics and also to evaluate the association of these patterns with overweight and obesity, among Lebanese adolescents. Based on the results, a study has identified two main dietary patterns, among the Lebanese adolescent population: the 'Western' and the 'traditional Lebanese', with the western pattern being associated with a higher risk of overweight in the study population (Naja *et al* 2015). On the basis of a study by, Ferranti *et al* conducted on 1586 individuals, aged 11–14 years, from 15 secondary schools of Sicily and Southern Italy, it has been found that less sleep and poor quality sleep were associated with a lower adherence to Mediterranean Diet, an increase in unhealthy eating behaviors and overweight/obese status. These findings highlight that, the prevention of adolescent obesity, needs a multidisciplinary approach considering not only physical activities and diet, but also other lifestyle interventions such as, improvising the sleeping habits (Ferranti *et al* 2016).

Like other parts of the world, obesity has been increasing in adolescents in Fiji and obesogenic dietary patterns need to be assessed, to inform health promotion there also; hence, a study by Wate *et al* was conducted to identify the dietary patterns of 6,871 adolescents, aged 13–18 years from 18 secondary schools in Fiji and determined their relationships with, standardized body mass index (BMI-z). Results indicated that, of the total sample, 24% of adolescents were overweight or obese, with a higher prevalence among Indigenous Fijians and females. Almost all adolescents reported frequent consumption of sugar sweetened beverages (90%) and low intake of fruits and vegetables (74%). Over 25% of the participants were, frequent consumers of takeaways for dinner, and either high fat rich/salted snacks, or confectionery after school. Nearly one quarter, reported irregular breakfast (24%) and lunch (24%) consumption on school days, while fewer adolescents (13%) ate fried foods, after school. Indo-Fijians were more likely than Indigenous Fijians, to regularly consume breakfast, but had a high unhealthy sugar sweetened beverages and snack consumption. Regular breakfast ($p < 0.05$), morning snack ($p < 0.05$) and lunch ($p < 0.05$) consumption were significantly associated with lower BMI-z score. Consumption of high fat-rich/salted snacks, fried foods and confectionery was lower among participants with higher BMI-z (Wate *et al* 2013). Another study was conducted to determine the dietary patterns of 1086 adolescents, aged 12–18 years in Australia and their associations with socio-demographic factors, nutrient intakes, behavioral and health outcomes. From the present study, it has been found that fruits, salads, cereals, and fish pattern was inversely associated with diastolic blood pressure ($P = 0.0025$) after adjustment for age, sex, and physical activity in adolescents ≥ 16 y (McNaughton *et al* 2008). A

study was conducted in Spain where a total of, 2519 students, aged 13–14 years, from 79 schools distributed all over the 17 autonomous communities, in Spain were asked to report through the CAL-TAS platform ,about their food intake and physical activity over one week. The body mass index, the consumption of food and beverages, the intake of macronutrients and micronutrients, and the values obtained from the PAQ-A questionnaire, which evaluated physical activity, were analyzed. Twenty percent of the participants were overweight or obese. In more than half of the subjects, the ingestion of fruits and beverages was less than recommended, whereas the consumption of meat, baked goods and fried foods was excessive. Moreover, adolescents with higher body mass index also presented worse eating habits and more inactivity. In conclusion, Spanish adolescents present low adherence to recommendations, provided by the Spanish Society of Community Nutrition (SENC) and by the World Health Organization. In order to prevent the obesity-related disorders, effective educational programs have to be designed. Indeed, adolescents and their families should be aware that, the early adoption of healthy dietary habits and of a correct physical activity may strongly improve their future quality of life (Roura *et al* 2016). A study was conducted, to determine the physical activity patterns in different domains like home, school, transport, leisure-time and their intensity categories i.e. light, moderate, and vigorous and their association with socio-demographic factors and socio-economic status, among secondary school adolescents in Nigeria. The study showed that, most of the secondary school adolescents in Nigeria, were not meeting the international recommendations for sufficient physical activity, and that, school-based physical activities and light intense activities were, the most prominent domain and intensity-category, of self-reported physical activities, respectively, in these adolescents. Younger age boy's high family SES and household car ownership were associated with, more leisure-time physical activity, moderate-to-vigorous physical activity and total physical activity, while high family SES and household car ownerships were associated with reduced active transportation, to and from school (Oyeyemi *et al* 2016). A study by Majid *et al* was conducted on 794 adolescents (aged 13-years), attending 15 public secondary schools, from the Central and Northern Regions of Malaysia, to investigate the baseline nutritional intake of Malaysian adolescents by gender, body mass index, and places of residence (urban and rural). The results indicated that, males had significantly ($P < 0.001$) higher energy intake than females (1774.0 ± 369.8 vs 1595.2 ± 320.6 kcal/d); adolescents in rural schools consumed more energy and cholesterol ($P < 0.001$) compared to, adolescents in urban schools (1706.1 ± 377.7 kcal/d and 244.1 ± 100.2 mg/d, respectively). Obese adolescents in rural schools consumed more energy and sugar (1987.6 ± 374.0 kcal/d and 48.9 ± 23.0 g/d) (P -value < 0.001). Also it has been found that, the dietary intake of normal weight versus obese adolescents, differs by the location of their school (Majid *et al* 2016).

In the recent years, with the change in rapid change in lifestyle pattern, adolescents spent a huge time on seeing television and playing video games, hence increasing the screen time. In this regard, a study was conducted, to examine the associations of youth physical activity and screen time with weight status and cardio-respiratory fitness in children (692 children aged 6–11 yrs) and adolescents (422 adolescents aged 12–15 yrs). Participant's physical activity, screen time questionnaires, their body mass index and cardio-respiratory fitness (adolescents only) were assessed. MET was assessed using additional physical activity questionnaire. It has been found that, among adolescent, screen time was significantly associated with being overweight/obese and being physically active was positively associated with cardio-respiratory fitness, independent of screen time among adolescents. In addition to it, it has been further reported that, screen time is a stronger factor than physical activity, in predicting weight status in both children and adolescents and only physical activity is strongly associated with cardio-respiratory fitness in adolescents (Bai *et al* 2016). A systematic review, by Carson *et al* was conducted, to update the relationships between objectively and subjectively measured sedentary behavior and health

indicators in children and youth aged 5–17 years. The findings from the review, based on very low to moderate quality evidence, from over 1.5 million participants around the world, indicates that, different types of sedentary behavior may have different impacts on different indicators of health. Across the majority of health indicators examined, higher duration of TV viewing and/or screen time was associated with unfavorable health. A gradient was observed across health indicators, indicating that, less sedentary behavior, especially screen time, has been found to be associated with better health (Carson *et al* 2016). The existing hypothesis predicts that, physical activity and media use compete in adolescents, although findings are inconsistent. A study, by Spengler *et al*, in this backdrop was conducted to determine the co-occurrence of physical activity and media use, by identifying clusters of adolescents with specific behavioral patterns including physical activity in various settings (school, sports club, leisure time) and different types of media use (watching TV, playing console games, using PC / Internet). A study was conducted on 2,083 adolescents (11–17 years) from all over Germany. Physical activity and media use were self-reported. Results demonstrated that, a high proportion of boys (33%) as well as girls (42%) show, low engagement in both physical activity and media use, irrespective of setting or type of media. Other adolescents were engaged in both kind of behaviors, but either physical activity (35% of boys, 27% of girls) or media use (31% of boys and girls) predominates. The result of this study support to some extent, the hypothesis that media use and physical activity compete: Very high media use occurred with low physical activity behavior, but very high activity levels co-occurred with considerable amounts of time using any media. There was no evidence that, type of media used was neither related to the physical activity levels nor the setting of physical activity was related to the amount of media use, in any pattern (Spengler *et al* 2015).

Eating behavior plays an important role in healthy eating and hence, influences development of obesity. In this backdrop, a study was conducted by, to describe dietary intake and eating behaviors of obese children and adolescents, and also, to determine how these differ in Indigenous versus non-Indigenous children. Baseline dietary intake and eating behavior records, were assessed from 239 participants (45% Māori, 45% NZ Europeans, 10% other ethnicities), aged 5±17 years. Two-thirds of participants, experienced hyperphagia and half were not satiated after a meal. Comfort eating was reported by 62% of participants, and daily energy intake was above the recommended guidelines for 54%. Fruit and vegetable intake was suboptimal compared with the recommended 5 servings per day and the mean weekly breakfasts were less than the national average. There was a concerning prevalence of abnormal eating behaviors and significant differences in dietary intake between obese participants and their national counterparts. Ethnic differences between Indigenous and non-Indigenous participants were also present, especially in relation to sweet drink consumption (Anderson *et al* 2016).

India, traditionally known as less developed country with an estimated 190 million adolescents (As per WHO age range) comprising over one-fifth of the entire population (Jejeebhoy *et al* 1998), childhood and adolescent obesity is escalating significantly. A review of childhood obesity prevalence studies in India revealed a large degree of variation in the prevalence of overweight (8.5-29.0%) and obesity (1.5-7.4%) among school-aged youth, with the highest prevalence among urban youth and youth of higher socio-economic status (Srihari *et al* 2007).

Timing of taking meal has also some impact on weight status of the adolescent individuals. Notable among these is the consumption of breakfast. Many studies undertaken in developed countries (Berkey *et al* 2003, Timlin *et al* 2008, Sandercock *et al* 2010), and some developing nations (Maddah *et al* 2010), suggest that the frequency of breakfast consumption is inversely associated with Body Mass Index (BMI) among school going children and adolescents.

In this regard, on the basis of the study from India, by Arora *et al*, conducted on school aged adolescent in Delhi,

it has been found that daily breakfast consumption is associated with less overweight and obesity and with healthier dietary- and physical activity-related behaviors among urban Indian students and hence the study recommended intervention programs to prevent or treat childhood obesity in India should consider emphasizing regular breakfast consumption (Arora *et al* 2012).

DISCUSSIONS

As adolescence is the crucial period for growth and development, meeting the optimum nutritional requirements in addition with proper physical activity is required to achieve optimum body composition and also physical fitness status. Obesity in adolescence, one form of nutritional extremes, has been linked with poor diet and insufficient physical activity. For adolescents, dietary guidelines recommend a healthy and balanced variety of food selections, as well as eating in moderation, in order to optimize the nutrition. Despite these guidelines, evidence has shown that dietary habit among adolescents is poor because of binging on energy-dense snacks and drinks. To curb the escalating problem of nutritional extremes in adolescent populations- consuming under and over than what is necessary—WHO has recommend a healthy diet low in fat, sugar and salt, and high in fruit and vegetables. Improving young people’s food habits is of great importance in addressing overweight and chronic diseases. This is relevant as food habits established in the early years tend to continue into adulthood. Developing countries like India have a unique problem of ‘double burden’ wherein at one end of the spectrum they have obesity in children and adolescents while at the other end having malnutrition and underweight.

In addition with direct food intake and regular physical activity, other factors have significant indirect impact on dietary pattern. Many systematic reviews have provided evidence that sleep patterns, sleep duration, and sleep quality are associated with overweight and obesity. People who sleep less had higher risk of being overweight/ obese, compared to longer ones, with a stronger association in boys than in girls. Studies have shown short sleep duration may affect food intake, appetite, satiety and energy balance through the modification of hormonal responses. Moreover, alterations in sleep patterns and sleep efficiency are often associated with unhealthy habits and lifestyle modifications, such as lower physical activities, consumption of high calories foods and beverages (Al-Hazzaa *et al* 2014).

School-based interventions can be major channels for many childhood obesity prevention programs. Transition to secondary school may involve new habits for adolescents, as they often may exercise more autonomy over their own food choice and have increased opportunities to access to unhealthy food, thus limiting parental influence on their dietary behavior.

Evidence regarding movement behaviors among school-aged children and youth (aged 5–17 years old) have traditionally focused on physical activity, typically of 60 minutes moderate- to vigorous-intensity (MVPA) per day. It has been found that Soccer, one of the most popular physical activities, has beneficial impact on obesity indices in adolescent boys (Bhattacharjee *et al* 2015, Banerjee *et al* 2014) receiving the training on football. For developing countries like India there may be some social and cultural acceptance of physical activity especially in females; In this regard, activities which are culturally appropriate, cost-effective, enjoyable, simple, easy to continue for a long period of time and effective, may be more encouraged from practical and feasibility point of view. Indian classical dancing, in particular, Bharatnatyam, and Kattthak, which can be good choice of physical exercise especially for adolescent girls, has been reported to have potential to favorably influence obesity status (Chatterjee *et al* 2014, Mukherjee *et al* 2014, Chatterjee *et al* 2015), especially central

obesity (Mukherjee *et al* 2013) on body composition (Mukherjee *et al* 2014, Mukherjee *et al* 2014), especially body fat (Banerjee *et al* 2014, Banerjee *et al* 2014), motor ability (Bhattacharjee *et al* 2014), pulmonary function indices (Kundu *et al* 2014, Banerjee *et al* 2014), diabetic markers (Banerjee *et al* 2015), physical fitness status (Mukherjee *et al* 2012) and also body shape indices related with cardio-vascular health status (Banerjee *et al* 2017); dancing has favorable impact on various obesity indices. Actually, when tackling childhood obesity, a multi-disciplinary approach is recommended, working with families to address food habits, physical activity and (lifestyle) behavior. Specific strategies are needed for this age group, since habits (healthy or not) established during adolescence are likely to persist into adulthood.

CONCLUSIONS

From the present review, it may be concluded that there is an increasing upward trend of prevalence of overweight and obesity in adolescents, an infrequently studied population group, all over the world. As the major modifiable contributing factors to prevent obesity are adopting healthy dietary habit combined with leading a physically active lifestyle starting from early childhood, increased attention on healthy living agenda from policy level is required to combat adolescent obesity. In this regard, low cost, feasible, low risk and enjoyable exercise like Indian classical dancing may be encouraged.

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