Obesity in Adolescent Boys: Physical Inactivity, Unhealthy Diets, Screen Time and Irregular Sleep

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Abstract

Background: The changes in diet and lifestyle- increased consumption of energy dense fast foods and a shift towards sedentary lifestyle has increased the risk of chronic diseases among adolescents.

Aim: The aim was to assess the factors associated with overweight and obesity (physical activity, dietary intake, screen time and sleep pattern) among adolescent boys.

Methods: Two hundred 12 to 18-year old boys were randomly selected. A questionnaire was used to obtain information regarding socioeconomic status, physical activity, dietary intake, sleep pattern and screen time from the boys.

Results: According to the BMI, 34% were underweight, 16% overweight, 7% obese. Only 43% boys had normal BMI. Eighty-one percent of adolescents performed short duration exercise regularly and 19% were physically inactive. The dietary intake of the participants was observed. In all participants, mean weekly consumption of processed food was the highest followed by fruits and vegetables. Seafood, egg, meat, nuts had a lower mean consumption. The consumption of processed foods, packed foods and aerated drinks was highest among the younger age groups as compared to the other age groups. Mobile phone was found to be the most commonly used (71%) electronic device by adolescent boys. Mean duration of sleep was observed to be approximately 7 hours.

Conclusion: Increased consumption of processed food, physical inactivity and increased screen time were related to the prevalence of overweight and obesity among adolescent boys. The results suggest that initiatives should be taken to educate adolescents to have a healthy lifestyle.

 Keywords: Adolescent boys; Obesity; Dietary intake; BMI; Physical activity.

Introduction

Obesity is a rapidly growing threat and it's as common as under nutrition, infectious diseases etc. Obesity is known to affect people of all ages and genders [1]. Childhood overweight and obesity has an adverse effect on physical and psychological health [2]. It is also a major risk factor for many chronic conditions (Type2 diabetes, cardiovascular disease, hypertension, cancer, sleep apnoea etc [3]. Environmental factors, lifestyle choices, genetics and cultural environment playan important role in the prevalence of obesity worldwide [4]. Consumption of high energy foods are linked to obesity. It has been documented that the main source of energy for adolescents is from bread, meat and meat products, potatoes/chips, confectionary and preserves; whereas consumption of fruits and vegetables is low [5]. Increase in sedentary leisure activities coupled with poor nutrition has lead to rise in body weights [6]. Factors such as time spent in using screen media (Television, videos, video games) and irregular sleeping patterns are considered as potential contributors to childhood obesity [7]. Thus, the present study was conducted to identify the prevalence of overweight and obesity among adolescent boys and to recognize factors influencing them.

Material and Methods

A cross sectional study was carried with 200 participants. Adolescent boys, attending schools and colleges between the age group of 12-18years were chosen. They were divided into three age groups: 12-14, 14-16 and 16-18 years. An informed

consent was obtained from the participants. Ethical approval for this study was given by the Ethics Research Committee, Maniben Nanavati Women's College, Mumbai.

A questionnaire was used to obtain information. The questionnaire consisted of sections regarding general information, physical activity, food frequency, sleep pattern and screen time. Using the Kuppuswamy Socioeconomic (SES) Scale (updated for 2019), the socioeconomic status score was determined and classified into upper class (I), upper middle class (II), lower middle class (III), upper lower class (IV) and lower class (V), SES categories [8]. The height was measured and recorded to the nearest 0.1 centimetres. The weight was measured and recorded to the nearest 0.1 kilograms (WHO, 1995). BMI was calculated to measure the weight status of the individual and BMI was classified as per Cole's classification [9].

A physical activity questionnaire was used (WHO, 2018) [10]. It included questions for different types of activities. The participant's response was recorded as the hours and days of physical activity per week. They were then categorized in sedentary, moderate and vigorous activity categories. The food frequency questionnaire included questions regarding frequency of foods consumed from various food groups- cereals, pulses, milk and milk products, nuts, fruits, vegetables, fish, poultry products, beverages, processed foods, packed foods (cake or pastries, and potato chips) and aerated drinks (non-diet soft drinks) and the portion sizes. The dietary intakes were considered as portion size per week for each of the food groups. For screen time, the adolescent boys were asked what form of device (mobile phones, laptop, T.V, tabs) they used for entertainment or for educational purpose. The duration and frequency of use of devices was asked. They were also asked regarding the social media applications used (Whatsapp, Facebook, Instagram, etc). The sleep pattern questionnaire was used to identify the association between sleep and overweight and obesity risk. The sleep pattern questionnaire included questions such as the bed time, wakeup time, and total duration of sleep. The data was analysed using Statistical Package for the Social Sciences (SPSS) version 26.0.

Results

In the present study there were no participants in the lower class. Most of the boys belonged to the upper middle-class category (44%) with least percent boys in upper class category (9%). The participants were divided into three age groups- 12-14 years, 14-16 years and 16-18 years.

Anthropometric Measurements

The mean height was 160.9 ± 12.7 cms, weight was 50.5 ± 14.9 kg and BMI was 19.5 ± 5.1 kg/m2. Anthropometric measurements were significantly different between the age groups (p<0.05).Weight and BMI was highest in the older age group of 16-18 (57.8 ± 12.9 kg, 20.6 ± 4.5 kg/m2) as compared to the youngest age group of 12-14 (42.2 ± 10.4 kg, 17.7 ± 3.6 kg/m2). Adolescent boys were classified as underweight, nor-

mal, overweight and obese based on Cole's standards (2007). There were 34% underweight and 43% normal weight boys. About 23% were overweight and obese. When the percentage of underweight, overweight and obese subjects was compared within the three age groups, percentage of underweight boys was higher in the younger age group (45.8%). Boys of 16-18 and 14-16 years were overweight (23%) and obese (13.8%), respectively. The differences in the age groups were statistically significant (χ2= 16.059, p = 0.013).

Physical Activity

Walking (5.4 ± 2.2 days), moderate activities (3.8 ± 2.9 days) and brisk walking (3.3 ± 2.9 days) were the most common activities performed by boys. Intense sports activity and vigorous activity had the lowest mean values of 1.2 ± 0.4 days and 2.5 ± 2.7 days respectively in this study.

When compared in age groups, vigorous activity was almost similar in all the three age groups. However, 12-14 year participants reported highest (2.7 ± 3.0 days) vigorous activity followed by the older age group (2.5 ± 2.4 days). The younger age group also had the highest mean value (3.7 ± 3.1 days) for brisk walking as well as moderate activity (4.3 ± 2.9 days) compared to the other two groups. The physical activity patterns were not significantly different in the age groups.

Time spent doing moderate activities, intense activity and sitting was highest among the younger age group as compared to the other two groups. However, time spent in watching TV was highest in adolescents of the middle age group (90.6 ± 103.3 minutes) and the 16-18 year age group boys had highest mean for time spent using phone/laptop (135.2 ± 122.3 minutes). Though 81% percent of boys performed exercise regularly, the duration of exercise differed. A little over 35% of the participants exercised for 30 minutes/day. Very few (10%) of the boys reported that they exercised for more than 2 hours.

Dietary intake

The mean consumption of various food groups is described herein. Processed foods had the highest mean value of 39.6 ± 45.1 servings per week and sea food had the lowest value of only 3.8 ± 5.5 servings per week. The mean consumption of fruits was 35.2 ± 30.7 servings per week, followed by vegetables such as tomato, cucumber, green salads (24.1 ± 22.9 servings per week) and cereals like rice, wheat, rice flakes, jowar etc. was (19.7 ± 10.0 servings per week). The mean consumption value of pulses, milk and milk products, and nuts were 14.2 ± 11.3, 10.3 ± 5.9, 16.1 ± 15.2 servings per week respectively. The mean weekly consumption of packed foods (13.9 ± 15.6 servings) and aerated drinks (19.1± 25.1servings) were high as compared to the consumption of green leafy vegetables (9.3 ± 10.2 servings), roots and tubers (5.9 ± 4.1 servings) and egg and meat (7.5 ± 7.3servings). Mean consumption of aerated drinks was high (19.1 ± 25.1 servings per week).

Table 1 shows the mean consumption of various food groups within the three age groups. The mean consumption of most

Table 1: *Consumption of Various Foods between Age Groups.*

Parameters	Age Group			F,p
	12-14	14-16	16-18	
Cereals	21.3± 9.7	19.8± 10.0	17.9± 10.1	1.721, 0.182
Pulses	16.9 ± 10.0	13.6 ± 11.2	12.3 ± 10.8	2.601, 0.077
Milk & milk products	10.1 ± 5.0	10.4 ± 6.4	10.2 ± 6.2	0.030, 0.971
Nuts	14.7 ± 9.0	17.0 ± 17.1	16.5± 17.2	0.393, 0.676
Other vegetables	21.3 ± 14.5	27.9 ± 30.4	22.0 ± 17.0	1.78, 0.170
Roots and tubers	6.1 ± 4.0	6.1 ± 4.1	5.5 ± 4.4	0.387, 0.680
Green leafy vegetables	9.6 ± 10.8	10.4 ± 10.0	7.5 ± 9.5	1.474, 0.232
Fruits	31.2 ± 25.1	38.1 ± 35.9	35.1 ± 28.1	0.841, 0.433
Egg and meat	6.9 ± 6.3	6.9 ± 7.8	8.8 ± 7.4	1.374, 0.256
Sea food	3.8 ± 5.6	2.6 ± 3.8	5.3 ± 6.8	4.352, 0.014
Beverages	7.8 ± 4.8	9.2 ± 7.2	8.7 ± 5.3	0.874, 0.419
Processed foods	43.6 ± 42.7	38.1 ± 45.6	37.8 ± 47.3	0.319, 0.727
Packed foods	15.0 ± 14.8	15.2 ± 16.5	11.1 ± 15.2	1.369, 0.257
Aerated drinks	19.6 ± 21.7	19.5 ± 25.8	18.1 ± 27.3	0.066, 0.936

of the food products such as cereals (21.3 ± 9.7 servings), pulses (16.9 ± 10.0 servings), processed foods (43.6 ± 42.7 servings) and aerated drinks (19.6 ± 21.7 servings) was higher in the younger age group. The mean consumption value of milk and milk products was almost similar in all the age groups. The age group of 14-16 had the highest mean consumption value for nuts (17.0 ± 17.1 servings), vegetables (27.9 ± 30.4 servings), green leafy vegetables (10.4 ± 10.0 servings), fruits (38.1 ± 35.9 servings) and beverages (9.2 ± 7.2 servings). The older age groups consumed lower amounts of roots and tubers (5.5

Screen Time

Fifty-nine percent of boys had a screen time use of 2-3hours. Almost 20% used electronic device for 4-5hrs and more than 15% had more than 7 hours of screen time exposure. Only 1% had less than 2hours of screen display. Forty-four percent of boys had access to more than two social media applications. Boys can be influenced by food related sites and so they were asked about it. It was observed that 38.5% of the subjects followed food related pages on social media and 59.5% did not follow any pages. Almost one-fourth of the boys were influenced by the food related sites on social media.

Sleep Pattern

The mean total duration of sleep of subjects in this study was 419.1 ± 116.3 minutes. Seventy-five percent of boys reported the same duration of sleep whereas 29.5% subjects had varied duration of sleep. It was observed that forty-three percent of the boys would fall asleep within 5-10minutes after going to bed. Twenty percent took more than 30 minutes to fall asleep. Participants were asked to rate their sleep. Fifty-seven percent boys rated their overall sleep as good, 31% rated their sleep as excellent and 5.5 % as bad.

Discussion

The present study was undertaken to identify various factors (physical activity, dietary intake, screen time and sleep pattern) that contribute to overweight and obesity among adolescent boys. Two-hundred boys of 3 age groups: 12-14; 1416 and 16-18 years participated in the study. As per the Kuppuswamy Socioeconomic Scale (updated for 2019) [8], most of the boys belonged to upper middle class (44%) and only 9%

belonged to the upper class.

When the participants were classified into underweight, normal, overweight and obese categories using the Cole's classification, 34% of the adolescent boys were underweight, 43 % had normal weight, 16 % were overweight and 7 % obese. SES has been associated with the BMI of adolescents [11,12]. They stated that BMI was higher among the lower income families. A study conducted by Rogers et al [13], also reported similar findings where the prevalence of higher BMI was seen among the low SES families.

In contrast, an Indian study by Jain et al., [14] reported that the prevalence was higher among the private school adolescents since they belonged to higher SES. Another Indian study reported similar prevalence of overweight among the urban Indian adolescent boys (17.8%) and it was high among the higher socioeconomic group [15].

In age groups, it was noted that the percent of underweight boys was higher in the younger age group 12-14 years (45.8%); and that of overweight and obese was higher in the oldest age groups of 16-18 (23.0%); it was 13.8% in 14-16, year age group. This can be linked to the fact that it is during this phase 14-18, when boys receive their pocket money for daily expenditure. A part of which may be spent in junk food.

In the present study it was observed that 34 % and 23% of the boys were found to be undernourished and over nourished, respectively indicating that more than half (57%) of the adolescent boys suffered from dual burden of malnutrition. Studies conducted to understand the prevalence of under nutrition and over nutrition among adolescents have reported that the percent of under nutrition (boys=43.10%; girls=50.10%) was lower and that of over nutrition (boys=2.40%; girls=1.70%) was high in boys as compared to girls [16,17].

This may be justified by the fact that in the Indian population a male child has a high preference as compared to a female child. The causes of under nutrition in adolescents are deprived nutrition due to socioeconomic status, lack of knowledge regarding nutritious food which may lead to nutrient deficiencies. Over the past few decades, rapid socioeconomic and demographic transition in India has resulted in the rise of urban population. The improved socioeconomic status has caused an increase in sedentary lifestyle and consumption of energy dense diets. Over nutrition has been associated with consumption of calorie dense food (increased household in-

come) and reduced physical activity [18]. Therefore, we see the emergence of double burden of malnutrition in urban populations.

Physical activity is known to play an important role in maintaining health. Insufficient physical activity can lead to excess body weight. Eighty-one percent of adolescents performed exercise on regular basis while 19% of them where physically inactive. In a study conducted by Kar and Khandelwal, (2015) [19], they reported that the risk of developing obesity was significantly high in those adolescents who were physically inactive. Gutin et al., (2008) [20], also reported that increased physical activity lowered the occurrence of overweight and obesity. In this study, 37% boys exercised for 30 minutes daily whereas 10.5% exercised for more than 2 hours. Though most of the boys were physically active, the percentage of overweight (16%) and obesity (7%) in boys was almost 25%.

The dietary intake of the participants was recorded. It was observed that the mean weekly consumption of processed food (39.6 ± 45.1 servings) was the highest followed by fruits (35.2 ± 30.7 servings) and vegetables (24.1 ± 22.9 servings). The study conducted by Canella [21], stated that individuals who consumed processed food had the highest likelihood of having obesity (32% more). Studies show that individuals who consume fast foods for at least once in a week have a 20% increased risk for developing coronary heart disease [22,23]. Rani et al., (2013) [24], in their study have reported that decreased fast food consumption (20%) with higher intakes of fruits (40%) and vegetables (75%) resulted in lower percentage of overweight (6.2%) and obese (5.2%) adolescents. Seafood (3.8 ⬚ 5.5 servings), egg and meat (7.5 ± 7.3 servings), nuts (16.1 ± 15.2 servings) had a lower mean consumption. Milk and milk products had a mean consumption of 10.3 ± 5.9 servings per week. The consumption of processed foods (39.6 ± 45.1 servings per week), packed foods (13.9 ± 15.6 servings per week) and aerated drinks (19.1 ± 25.1servings per week) was highest among the younger age groups as compared to the other age groups. Different food groups were correlated with body mass index. Most of the food groups showed an inverse correlation whereas seafood, beverages and aerated drinks had a positive correlation.

An increased consumption of fried food is known to cause an increase in BMI and central obesity [25,26]. It has been suggested that vegetarian diets rich in whole grains, nuts, pulses, and legumes may provide defensive effects against the risk of overweight and obesity [27,28]. Evidence has stated that intake of fruits and vegetables decrease the risk of obesity [24,29,30]. A study has reported their observations that adolescents who consumed fruits, vegetables, pulses and nuts more than 2 times a week had lower BMI as compared to those who never consumed those foods [31].

Among the Indian population, cereals form the staple diet, however it has been noticed that there has been a substantial decrease in the cereal intake as per the recommendations. This decline in cereal consumption may be caused to the change in diet that is the shift towards energy dense foods [18]. Abstaining from consumption of meat and meat products is due to the dominance of vegetarianism in the Indian culture supported by religious beliefs of Hinduism, Jainism

and Buddhism [32,33]. Thus vegetarian Indians get their protein source from milk and milk products, pulses and legumes. In the present study the mean consumption of pulses and milk was poor thus may be the cause of increase in disease burden from under nutrition and micronutrient deficiency.

Screen time use has a direct impact on physical and mental health. Several studies have shown that use of screen time for a long period of time is associated with increased body mass index. Fifty-nine percent boys had a screen time use of 2-3 hours per day. A study conducted by Mitchell et al., (2013) [34], examined the relation between screen time and BMI reported a positive association between increased screen time and higher BMI. Studies have shown that increased use of electronic devices have caused an increase in obesity among adolescents [35,36]. However, a cross sectional study by Beyerlein et al., [37] reported that screen time was not uniformly associated with BMI. This supports the present study as increased screen time was not associated with higher BMI. However, it was observed that 38.5% of the boys followed food related pages on social media. Almost 1/4th of them were influenced by food related sites. The advent of various online food ordering applications (Zomato, Food Panda, Swiggy, Uber eats) has made it easier for customers to order food. This has lead to lack of physical activity which results in increased problem of over nutrition or obesity [38]. Nineteen percent used electronic device for 4-5 hours and 15.5% had more than 6-7 hours of daily screen time exposure. Mobile phone was found to be the most commonly used electronic device by 71% of adolescent boys.

Lack of proper sleep has been linked to weight gain and increase in obesity. The average duration of sleep for adolescents should be between 7-9 hours. In the present study mean duration of sleep was observed to be approximately 7 hours which falls under the adequate range of sleep duration [39]. Several studies have showed short sleep duration to be a risk factor for the development of obesity and its complications. In a cohort study by Magee et al., [40] it was observed that short sleep duration and increased work hours was associated with higher BMI in men. Royant- Parola et al., [41] stated their results that use of social media (mobile phone) among adolescents was associated with reduced sleep time. The duration of sleep is known to reduce in teenagers due to participation in various activities and even after school activities like homework, projects etc. Quality of sleep is an important factor. Boys rated their sleep as excellent (31%) and good (57%).

Conclusion

Adolescence, the period of physical growth causes an increased demand for calories and nutrients. In this study increased consumption of processed food along with physical inactivity, increased screen time were related to the prevalence of overweight and obesity among adolescent boys. The results suggest initiatives should be taken to educate adolescents to consume a healthy diet and a healthy lifestyle.

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