A Study On Determinants Of Obesity In Children Between 5-15 years of Age

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Abstract :

Background: Childhood obesity is one of the most serious public health issue. The prevalence of obesity is increasing both in developing and in developed countries. The global prevalence of overweight and obesity in children aged 5 -17 years is 10%, In India it is 22% among children between 5 to 19 years. The key causes of childhood obesity are unhealthy dietary habits and reduced physical activity. The adoption to sedentary lifestyle and unhealthy dietary habits increases the risk of overweight/obesity and non communicable diseases such as insulin resistance, type 2 diabetes mellitus, and metabolic syndrome like dyslipidemia, cardiovascular risks stroke and hypertension. **Objective:** To assess the BMI, various factor influencing BMI and to correlate these factors in children between 5 to 15 years age irrespective of sex and ethnicity. **Methodology:** Study included 648 healthy children after fulfilling inclusion criteria ,there socio-demographic information, diet history, history regarding daily physical activity, sedentary behaviour, time spent for recreational activities was taken and there height, weight was recorded and BMI was calculated. By using standardized IAP GROWTH CHARTS children were categorised as underweight, normal, overweight/ obese. **Result:** Prevalence of overweight was 14% and obesity was 7.3% in children between 5 to 15 years of age. **Conclusion:** Adolescent age ,children belonging to upper and upper middle socioeconomic status, family history of non-communicable diseases, Calorie intake more than RDA for age, Protein consumption less than RDA for age, consumption of mix diet (veg + non veg), less consumption of a balanced diet, lack of physical activity were associated with overweight and obesity.

Keywords: overweight/obesity, sedentary lifestyle, high calorie consumption, less protein consumption, mixed diet, less consumption of balanced diet.

Introduction :

The challenge of the 21st century of childhood obesity is one of the most serious public health issue. The global prevalence of overweight and obesity in children aged 5 -17 years is 10%and 22.0% among children from 5 to 19 years in India.[6,7] The highest prevalence rates of childhood obesity have been observed in developed countries; however, its prevalence is abnormally increasing in developing countries as well.

The result of Several studies highlight recent evidence regarding the role of genetics, age, gender, birth weight, dietary pattern, eating fast foods- and snacks and skipping breakfast. And behavioural- characteristics, sedentary- activities, physical activity -pattern, and sleeping- hours related to occurrence of obesity in-children and adolescents. The inculcation to sedentary lifestyle along with the adoption of unhealthy dietary habits increases the risk of obesity and non communicable diseases such as insulin resistance, type 2 diabetes mellitus, and metabolic syndrome like dyslipidemia, cardiovascular risks stroke and hypertension. Maintaining adequate calorie intake particularly for children and young people who have little direct control over food and activity choices is a significant challenge. Primary prevention is an important strategy for preventing obesity, behavioural changes, physical activity and diet control being the core interventions. If parents enforce a healthier lifestyle at home, many obesity problems could be avoided. Teaching children at home about eating healthy, exercising and making the right nutritional choices will eventually lead into other aspects of their life. This over the time, decrease childhood obesity and lead to a healthier society as a whole. Considering the increasing burden of obesity and its public health concern. This study is planned for assessing determinants of obesity that have led to this paradigm shift, so that the results of the study would help frame measures of prevention to curtail the adverse health outcome would be suggested.

Methodology :

Objectives: To assess the BMI of children between 5 to 15 years of age irrespective of sex and ethnicity

- To assess various factors influencing BMI.

- To correlate the influence of various determinants towards obesity in normal and obese children.

Place of study: Dr .D . Y. Patil Medical College, Hospital and Research Centre, Pimpri Pune 411018

Type of study: Cross sectional observational study.

Period of study: study was carried out over a period of 2 years, from October 2017 to October 2019

Ethical clearance: Ethics clearance was obtained from Institutional Ethical committee

Sample size: a total of 648 healthy children.

Source of data: Children visiting the OPD for immunization and children from the schools of Pimpri chinchwad Municipal Corporation area (both government and non-government).

Inclusion criteria: Healthy children of both sex and ethnicity in the age group between 5 to 15 years.

Exclusion criteria: Children suffering from any chronic diseases. Children with any endocrinal, congenital diseases leading to nutritional disorders, Children on psychotropic drugs, anti-epileptic drugs, steroids, Children or care takers not willing to voluntarily participate.

Study protocol: A written permission was obtained from the school principal & parents/ guardians of the children in parents teacher after explained about study. Healthy children fulfilling the inclusion criteria were screened and out of which 648 children who were voluntarily willing to participate were included in study. A detailed socio - demographic information was documented in predesigned proforma. Diet history was obtained by 24 hr recall method [1] on random 3 days in 1 week. Starting with the first thing eaten in the morning until the last food item consumed before waking up in next morning was asked. Name of food (bread+butter+jam), food description (wholemeal bread with salt+low fat butter+fruit jam), household amount (wati, number of chapattis/bread slices, table spoon etc.) and frequency of meals were asked and total calorie and protein intake was calculated. Vegetarians were those who eat vegetables and do not eat meat, chicken, eggs along with vegetables, those who eat meat, chicken, eggs along with vegetables were labelled as consuming mixed diet. Pizza, samosa, pasta, chips, cakes, pastries, biscutes, sugar beverages, burger, noodles and others were considered as junk food.

History regarding physical activity was recorded from a typical week. A detailed physical examination was performed and anthropometric measurements were recorded such as **Weight:** Weight was measured in kilogram(kg) by a digital weighing machine with child wearing minimum permissible clothes **Height:** The height was measured with help of stadiometer in centimetres. The individual standing on a firm levelled surface, without wearing any foot wear, and stand with feet held together, with heels, calves, buttocks, dorsal spine and head held in Frankfurt plain in same plane. **Body Mass Index (BMI):** It is calculated from height and weight measurements. From the obtained weight and height BMI will be calculated using revised IAP growth charts for height, weight and BMI.

$$BMI = Weight(KG)/ Height (Meters^2)$$

The children were categorized as underweight, normal and overweight/obese by using IAP GROWTH CHARTS application developed by IAP growth chart committee.

Statistical methods: Statistical analysis has been carried out using SPSS (version 25) for Windows package (SPSS Science, Chicago, IL, USA). Quantitative data has been expressed as mean +/- SD, while qualitative data has been expressed as frequencies and percentages. P values <0.05 have been considered as significant. Independent T test and chi square test respectively have been used to examine associations between means of continuous and categorical variables. One way ANOVA has been used to examine associations between multiple variables.

Results :

Table 1: Association between age, calorie intake and BMI in study group

Age (Years)	RDA (kcal/day)	Calorie intake (kcal/day)	BMI (Kg/m2)			Chi-square P Value
			Underweight (n=58)	Normal (n=452)	Overweight & obese (n=138)	
<6	1350	1000 – 1400	2	28	0	58.63 <0.0001
		1401 – 1800	0	20	0	
		1801 – 2200	0	1	0	
		2201 – 2600	0	0	5	
		2601 & above	0	0	1	
7 – 9	1690	1000 – 1400	17	9	0	194.63 <0.0001
		1401 – 1800	4	99	3	
		1801 – 2200	0	0	0	
		2201 – 2600	0	0	12	
		2601 & above	0	0	7	
10 – 12	2100	1000 – 1400	16	0	0	143.29 <0.0001
		1401 – 1800	0	41	0	
		1801 – 2200	0	6	0	
		2201 – 2600	0	1	4	
		2601 & above	0	0	7	
13 – 15	2540	1000 – 1400	18	4	0	561.07 <0.0001
		1401 – 1800	1	54	0	
		1801 – 2200	0	173	2	
		2201 – 2600	0	6	29	
		2601 & above	0	10	68	

Table 2: Association between age, protein intake and BMI in study group

Age (Years)	RDA (g/day)	Protein intake (g/day)	BMI (Kg/m2)			Chi-square P Value
			Underweight (n=58)	Normal (n=452)	Overweight & obese (n=138)	
<6	20.1	10 – 20	1	40	0	18.14 <0.0001
		21 – 40	1	9	6	
		>40	0	0	0	
7 – 9	29.5	10 – 20	17	66	2	26.13 <0.0001
		21 – 40	4	42	20	
		>40	0	0	0	
10 – 12	40	10 – 20	15	0	0	69.75 <0.0001
		21 to < 40	1	46	11	
		=40	0	2	0	
13 – 15	53	10 – 20	13	6	0	180.29 <0.0001
		21 – 40	6	197	97	
		>40	0	44	2	

Table 3: Association between age, Junk food consumption and BMI in study group

Age (Yrs)	Junk food consumption	BMI (Kg/m2)			Chi-square P Value
		Underweight (n=58)	Normal (n=452)	Overweight & obese (n=138)	
6 – 8	No	0	19	0	143.72 <0.0001
	1 – 2day	14	84	1	
	3 – 4day	0	13	0	
	5 – 6day	0	0	16	
	Daily	0	7	1	
9 – 11	No	3	9	1	77.87 <0.0001
	1 – 2day	17	41	1	
	3 – 4day	0	3	0	
	5 – 6day	0	0	12	
	Daily	1	3	0	
12 – 14	No	0	17	0	191.05 <0.0001
	1 – 2day	18	119	2	
	3 – 4day	2	10	1	
	5 – 6day	0	8	56	
	Daily	0	25	7	
15	No	0	8	0	115.38 <0.0001
	1 – 2day	1	62	0	
	3 – 4day	0	8	0	
	5 – 6day	0	0	32	
	Daily	2	16	8	

Discussion :

In the present study the percentage of overweight were 14% while the percentage of obesity was 7.3%. In a similar study done by Shanmugam et al[2], the prevalence of overweight and obesity among children was 8.32% and 4.72%, respectively.

It was observed that majority of the subjects were in the age group of 12-14 years of age. Majority of the subjects were male (54.01%) with male: female ratio of 1.17:1.A similar study done by Krishnan RN[3] and Verma et. Al[4] reported 55% were boys and the remaining 45% were girls. A maximum number of students were in 11year age group (254, 20%)

In the present study 69.8% were normal, 14% were overweight and 7.3% were obese. It was observed that the percentage of children who were overweight/ obese was increasing with age. Out of the 138 overweight / obese participants 106 were more than 12 years of age and the difference observed was statistically significant (p<0.0001).

A study done by Krishnan RN[3] have also observed similar trends in incremental BMI increase in adolescents compared to children. In the present study the percentage of overweight and obesity was higher in male as compared to female and the difference observed in gender distribution and obesity was statistically significant (p=0.047). Shanmugam et al[2] also observed greater prevalence of obesity in boys when compared to girls (6.43% vs. 2.96%) and there was no statistically significant association between prevalence of overweight/obesity among boys and girls within this study.

It was observed that 95.2% children were Hindu while 4.8% were Muslim. Majority of the children were belonging to lower middle class (44.1%) followed by upper middle class (19.4%).

It was observed that majority of the overweight/ obese children were belonging to upper class (90 out of 138) 65.2% while majority of the normal children were belonging to lower middle class (231 out of 452)51.1%.

This difference observed was statistically significant (p<0.0001). Similar study conducted by Marwaha et al[5] showed that among children in the upper Socio economic class the prevalence of overweight and obesity were 17% and 5.6 % in boys and 19% and 5.7 % in girls, respectively, whereas in the lower Socio economic class the values were 2.7% and 0.4% in boys and 2.1% and 0.5% in girls, respectively. In the present study 65.4% of children were having mixed diet while 34.6% were vegetarian in present study. Verma et. al[4] in his study observed 66% were vegetarian as compared to 34% children who were non vegetarian in their study.

Amongst the 138 overweight/obese children 126 (91.3%) had a mixed diet and only 12 (8.6%) were having vegetarian diet while out of 452 normal children 266 (58.8%) were having mixed diet and 186 (41.1%) were having vegetarian diet and the difference observed was statistically significant (P<0.0001). In a similar study by Verma et al[4] out of 94 obese children, 44 (46.8%) were vegetarian as compared to 50 (53.2%) were non-vegetarian. There was a statistically significant association (P = 0.003) between BMI and their corresponding dietary habits.

It was observed that 39.8% children eat balanced food for 5-6 days per week, while 29.9% eat balanced food daily, only few children (7.3%) eat balanced diet for 1-2 days. The children who had balanced diet daily or for more than 5-6 days had a normal BMI as compared to obese /overweight children who had balanced diet for few days in a week (1- 4 days /week). This was statistically significant.(P< 0.0001)

Mixed diet and low consumption of balanced diet was significantly associated with overweight/obesity. The habit of consumption of junk food was observed in children with all categories of BMI. Most of underweight /normal children consumed junk food for 1-2 days /week while most of overweight/obese children consumed junk food for 5-6 days /week, and this behaviour was more prominent in mid adolescent.

In a similar study conducted by Verma et. Al[4] reported that out of 147 overweight children, 87 (59.2%) use to take junk/fast food 1–2 days/week. Out of 94 obese children, 52 (55.3%) use to take junk food 1–2 days /week. Those who were taking junk food 2–4 days /week {n =51 (43.7%)} students out of total 147 were overweight and {n= 25 (26.6%)}students out of 94 were obese. This was found to be statistically significant (P = 0.001).

Family history of non communicable diseases was present in 14.8% children. It was observed that family history of Non communicable disease was present among 55.7% of overweight /obese (77 out of 138) Only few children 2.8% (13 out of 452) with normal BMI were having family history of Non communicable disease and the difference was statistically significant (P<0.0001). A similar result was observed in study done by Verma et. Al[4] who reported 147 overweight children, 45 (30.6%) had positive family history of Non communicable disease. In 95 obese children, 37 (39.4%) had positive family history of non communicable diseases.

It was observed that children in the present 18.4% children were doing vigorous activity daily , while39.5% children were doing vigorous activity 3-4 days /week while 34.4% were not doing any vigorous activity. The duration of vigorous activity performed by 10.6% children was 5-6hrs/day , by 50.6% of children was 3-4hrs/day and 34.4% children did not perform any vigorous activity. Majority of children (72.4%) performed Moderate intensity activity daily, 19.6% did not performed any moderate intensity activity. 63.7% children's performed moderate intensity activity for 3-4 hrs/day. 65.4% of children had a sedentary behaviour for 3-4 hrs/day followed by 23.1%. who had a sedentary behaviour for 5-6 hrs/day. Yoga activity was practised in only 3.1% children.

While studying the association between vigorous activity and overweight/obesity it was observed that as the duration and time of vigorous activity decreases the prevalence of overweight/obesity and it increases with statistically significant difference (p<0.0001). 133 out of 138 overweight /obese children (96.3%) did not perform any vigorous intensity activity and 105 out of 138 (76%) did not perform moderate intensity activity, 75 out of 138 overweight /obese children (54.3%) had a sedentary behaviour for 5-6hrs /day. All of them did not involve in any of the yoga activities. In study by Verma et. Al[4], reported that out of total 147 overweight children, 125 (85.0%) spend 1–2 hrs in outdoor activity, whereas only 6 (4.1%) children spend >2 h in outdoor activities. Out of total 94 obese children, 68 (72.3%) spend 1–2 h in outdoor activities and 14 (14.9%) children spend >2 h in outdoor activities. An association of statistical significance (P = 0.001) was found between BMI and their corresponding duration of time spent on outdoor physical activity.

It was seen that majority of children with normal weight were involved in daily moderate physical activity while majority of the overweight/obese children were not doing moderate intensity activity. It was also observed that as the duration of moderate intensity activity was decreasing the BMI of the children was shifting towards overweight and obesity with statistically significant difference. It was seen that no overweight/ obese child was doing yoga while 20 normal BMI children out of 425 were doing yoga activity.

It was observed that the proportion of sedentary behaviour/day was more among the overweight/obese children (133 out of 138) as compared to normal children(54 out of 452). And the difference was also statistically significant (P<0.0001).

It was observed that calorie consumption more than reference RDA for age was proportionately associated with overweight/obesity and this was statistically significant. protein consumption more than reference RDA for age decrease the risk of overweight /obesity.

Conclusion :

The determinants of obesity as observed in this study were :

1. Non modifiable factors like male sex and family history of NCD were significantly associated with overweight and obesity.

2. The majority of children who were obese/overweight belonged to adolescent age group as compared to younger children group.

3. Children belonging to upper and upper middle socioeconomic status had a increased risk of obesity as compared to children from lower middle and lower class.

4. The dietary practice of consumption of mix diet (veg+non veg.) and less consumption of a balanced diet(<4days /week) was associated with overweight and obesity.

5. There was statistically significant association between the number of days junk food consumed (>5-6days/week) and obesity /overweight.

6. Children consuming more calories than the RDA/day for that age group were observed to be obese/overweight.

7. In children between age group of 10-15 yrs, consumption of less protein as compared to the recommended dietary allowance (RDA/day) day was strongly associated with obesity.

8. Those children who did not perform moderate–vigorous physical activity at all were found to be overweight/obese. It was observed that those children who had a normal BMI performed moderate physical activity daily or vigorous physical activity for more than 3-4 days and yoga activity.

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