PREVALENCE OF OBESITY AMONG SCHOOL CHILDREN IN MADURAI

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ABSTRACT

Aim: The objective is to find the prevalence of obesity among school children aged 6 to 12 years in Madurai and to investigate the factors promoting rise of weight in children.

Methodology: It is a cross sectional observational study. The sample size is 2519 children from 2 rural and 2 urban schools. Height is measured by stadiometer and weight by electronic weighing machine. Body Mass Index is calculated and plotted on the Indian Academy of Pediatrics Body Mass Index chart (IAP-BMI) 2015 for boys and girls. Children are classified as underweight, normal, overweight and obese. Factors causing obesity assessed were age, gender, place of residence, birth weight, preterm/term, socio-economic status, Parents BMI, Environmental factors (physical activity, TV/Video gaming duration, Transport to school, Environmental safety), Food habits and sleep pattern.

Result: The prevalence of obesity and overweight are 9.3% and 16.8% respectively. Obesity has strong association with the place of residence and socio-economic status (p<0.001). No correlation was noted between age and gender in relation to obesity, but there is an increase in Mean and Standard deviation of BMI as the age increases. Regression analysis identified sedentary lifestyle; unhealthy food patterns like snacking, sleep deprivation and birth weight as risk factors. Protective factors identified were to prefer fruits and vegetables for healthy diet, adequate physical activity like walking to school, outdoor play etc. and visiting restaurants rarely. Parental obesity showed no correlation to the prevalence of obesity in their children.

Conclusion: Prevalence of obesity among school children is 9.3% and overweight is 16.8% in Madurai. Modifiable factors are the commonest causative factor; hence early life style modification is of utmost importance to the native community.

Key Words: Obesity, Overweight, Prevalence, Risk factors, Protective factors

INTRODUCTION

Obesity in children is a complex disorder. Its prevalence is increasing in recent years so as to consider it a major health concern both in the developed and developing world [1], [2], [3]. The ill effects of obesity on health are not fully reversible. So focus on preventing obesity is needed. Since overweight and obesity in adult life are predicated by childhood weight, prevention of obesity should start early in life.

Many factors, including genetics, hormonal influence, in-utero environment, metabolic changes, lifestyle changes, socioeconomic status, nutrition status of parents, sleep pattern and eating habits, are believed to play role in the development of obesity. But, more than **90%** of cases are due to modifiable factors and only less than **10%** are due to hormonal or genetic changes. Addressing different areas by focus-ing on behavioral changes and environmental modification towards healthier lifestyles will be the primordial treatment to decrease childhood obesity.

One of the important target groups is the school-age children, especially the pre adolescents who are old enough to understand and young to be influenced.

MATERIALS AND METHODS

The participants were 2519 children from 2 urban and 2 rural schools of Madurai. Children aged between 6 to 12 years are included in the study. The study protocol and procedures are approved by the research ethics committee of Madurai Medical College affiliated to The Tamil Nadu Dr MGR Medical University.

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The nutritional status of the child is classified as underweight, normal, overweight and obese was based on IAP-BMI chart 2015. Information collected are regarding age, gender, place of residence (urban or rural), birth weight (Small for gestation (SGA i.e.< 2.5 kg), Appropriate for Gestation (AGA i.e. 2.5 kg to 4.0 kg) or Large for Gestation (LGA i.e. >4.0 kg), preterm/term, socio-economic status (according to updated modified Kuppusamy's scale for rural areas and updated modified Prasad's scale for urban areas), parents BMI, environmental factors (physical activity, TV/Video gaming duration, transport to school, environmental safety), food habits and sleep pattern.

Questionnaire and profoma are distributed to the school children on the day of parents teachers meet and details filled by the author. Age was taken as per the completed years on the school records. Height of the child was measured using a stadiometer. Standing height was measured by making the child to stand against the fixed calibrated rod with the adjustable head rest without footwear, standing erect, looking forward with feet's together. Weight was measured in kilograms using a standard electronic weighing machine without footwear and with light clothes.

Separate IAP BMI percentile charts were used for girls and boys. After calculating the BMI for every child BMI was plotted on the IAP gender specific percentile chart 2015 and BMI status of the child assessed. Factors influencing obesity was also analyzed.

STATISTICAL ANALYSIS

The data's were entered in Microsoft Excel 2014 and statistical analysis done using SSPS 18 software. The mean and Standard deviation of Body Mass Index in various age groups and sex are calculated and plotted in a scatter diagram. Analysis of Variance (ANOVA) is used to test their significance. Other statistical methods used to analyze were Frequencies, Distributions, Confidence Interval, Chi-square test and Regression analysis. Since the Body Mass Index in boys and girls and urban and rural children has significant differences, data's were

analyzed both as a whole sample and separately for boys and girls. P value < 0.05 is taken statistically significant.
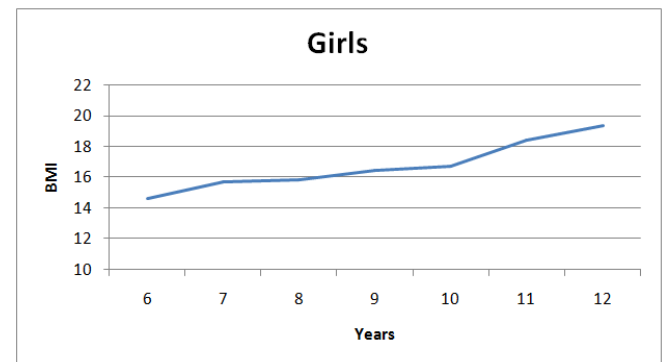
RESULTS

Table 1: Nutritional Status

BMI Category	Frequency	Percent
Normal	1704	67.6%
Adult equivalent over weight	423	16.8%
Adult equivalent Obesity	234	9.3%
Underweight	158	6.3%
Total	2519	100.0%
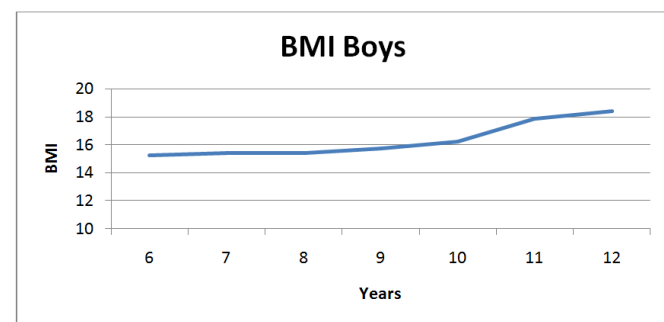
Figure 1: Mean and SD of BMI in Boys according to age.

Figure 2: Mean and SD BMI in each age in Girls.

Table 2: Nutritional status of rural and urban children

Type of school	Normal	Adult equivalent overweight	Adult equivalent obesity	Underweight	Chi square	P value
Rural	653 (72.7)	100 (11.1)	39 (4.3)	106 (11.8)	136.7w	<0.0001
Urban	1051 (64.8)	323 (19.9)	195 (12)	52 (3.2)		

Table 3: Gender and Obesity.

Gender	Non obese	obese	chi-square	P value
Male	1305(57.1)	141(60.3)	0.859	0.354
Female	980(42.9)	93(39.7)		

Table 4: Socio Economic Status.

Socio Economic Status	Non obese	Obese	Chi square	P value
Upper	2 (0.1)	0	13.481	0.004
Upper middle	887 (38.8)	119 (50.9)		
Lower Middle	1324(57.9)	111 (47.4)		
Upper lower	72 (3.2)	4(1.7)		

Table 5: Term vs. Preterm

Characteristics	Non-obese	Obese	Chi square	P value
Term	2270(99.3)	232(99.1)		
Preterm	15(0.7)	2(0.9)	0.124	0.724

Table 6: Birth Weight.

Birth weight	Non obese	Obese	Chi square	p value
> 4 kg	30 (1.3)	8(3.4)	7.669	0.0217
2.5 kg to 4 kg	1893 (82.8)	196(83.8)		
< 2.5 kg	362(15.8)	30(12.8)		

Table 7: Sleep deprivation in correlation to Obesity.

Sleep	Non-obese	Obese	Chi-square	P value
<10 hours/day	616(27)	108(46.2)	20.904	<0.0001
>10 hours/day	1669(73)	126(53.8)		

Table 8: Parental obesity

Parental Obesity	Non-obese	Obese	Chi-square	P value
Present	1608(70.4)	156(66.7)	1.388	0.239

Table 9: Logistic Regression Analysis

Variables	B	S.E.	Wald	df	Sig.	Adjusted OR
Preferred foods			16.911	2	.000	
Preferred foods(Vegetables)	-.680	.193	12.368	1	.000	.507
Preferred foods(Fruits)	-.559	.184	9.242	1	.002	.572
Hours of outdoor play			19.408	2	.000	
Hours of outdoor play(1-3hours)	-.588	.165	12.747	1	.000	.556
Hours of outdoor play(>3 hours)	-1.100	.346	10.133	1	.001	.333
Visits to restaurant			16.117	2	.000	
Visits to restaurant (more than once weekly)	.713	.650	1.202	1	.273	2.040
Visits to restaurant (Occasionally)	-.638	.179	12.755	1	.000	.528
Time on TV/VG			1.208	2	.547	
TV/VG(1-3hours)	.159	.204	.606	1	.436	1.173
TV/ VG(>3hours)	-.032	.182	.031	1	.859	.968
Pocket money	.479	.151	10.067	1	.002	1.615

Duration of sleep(< 10 hours)	.592	.218	7.398	1	.007	1.808
Transport			1.161	2	.560	
Cycling	.311	.442	.496	1	.481	1.365
motor vehicle	.280	.263	1.134	1	.287	1.323
Unsafe Neighborhood	-.295	.201	2.137	1	.144	.745
Constant	-2.641	.397	44.187	1	.000	.071

Table 10: Studies on prevalence of Obesity in India.

Author	Year	Place	Age	Prevalence of Obesity	Settings
Supreet Kaur MD et al[3]	2006	Delhi	5-18 yrs	2.45%	School
Preetam B Mahajan et al[2]	2007	Pondicherry	6-12 yrs	2.12%.	School
Pediatric Oncall Journal[1]	2012	Patiala Punjab	6-15 yrs	7.6%	School
Nora El-Said Badawi et al[5]	2012	Egypt	6-12 yrs	13.5%	School
Alice T Cherian et al[6]	2012	Kochi, Kerala	6-15 yrs	3.0% - boys 5.3% - Girls	School
Premnath M et al[7]	2010	Mysore	5-16 yrs	3.4 %	School

DISCUSSION

In this cross sectional study on 2519 children, the prevalence of Obesity was 9.3% (n=234) and overweight was 16.8% (n=423). Studies conducted in Amritsar showed 6.3% obesity and 11.9% overweight. Screening study in the nearby Pondicherry state [2] showed a prevalence of 3.8% obesity and 7.8% overweight. The following table reveals the rise in prevalence of obesity and need for prompt intervention.

Age distribution and obesity:

In our study BMI increases with age and with no gender variation, but there is no statistical difference in the prevalence of obesity related to increase in age (p value is 0.303). Studies done by Preetam B Mahajan et al[2] in Pondicherry among school children aged 6-12 years, studies in Egypt by Nora-El-Said[5] and Shiji K Jacob in Ernakulum, Kerala[8] also inferred that no increase in obesity noted in school age and obesity increases only during the pubertal age.

Effect of gender on prevalence of Obesity:

In our study prevalence of obesity among boys and girls were 9.7% (n=141) and 8.0% (n=93) respectively. P value was 0.354 and statistically insignificant. This delineate that comparing the obesity status between the genders in the age group of 6 to 12 years, does not show any relationship with obesity. Studies by Cynthia L. Ogden et al [9] in Maryland USA, and Helen et al [10] study also had the same views.

Association of obesity with place of residence

In this study prevalence of obesity in urban and rural schools were 12% and 4.3% respectively. This result was statistically highly significant with p value <0.001. Parekh Alok et al [11] reported in 2009 obesity to be less in rural school than in urban schools. Similar result was note by Unnithan et al [12] as urban children showing 6.73% and rural children with 2.93% obesity rates in Trivandrum educational district. A study by Preetam B Mahajan et al [2] in the union territory of Pondicherry and by shashidhar et al [13] in south Karnataka also has similar.

Association between sedentary life styles and obesity:

Our study showed significant association between obesity and sedentary health behaviors with p value being < 0.001 and statistically highly significant. Irrespective of the gender and place of residence, obesity has strong association with sedentary lifestyles. Studies done by Ann Smith et al [14] in Texas and Aggarwal et al [15] in Punjab have also proved the relation between sedentary lifestyle and obesity.

Sleep deprivation and obesity:

Our study also shows positive correlation between sleep deprivation and obesity (p value was <0.0001) and statistically significant. Studies one on semi-urban south Indian children by Kuriyan R et al [16] and study published in bmj by Philippa J Carter and the Nixon GM, Thompson et al [17] have confirmed this hypothesis. In study by Beccuti et al [18] laboratory evidence have confirmed the association between sleep loss and increased risk of obesity.

Influence of parental obesity on childhood Obesity:

In this study Parental obesity was not found to have any significant association (P value=0.239). Whitaker et al [19] study says parental obesity is not a stronger predictor in older children, but the child's obesity is the most important predictor of adult life obesity.

Birth weight and child's obesity:

In our study prevalence of obesity increases as the birth weight increases (p value of 0.021) which is significant. Meta-analysis done by Yu ZB, Han SP et al[20] has inferred same results. Similarly studies by Barry Caerphilly et al [21] concluded with similar results stating that as there is a statistical significant increase in obesity as the birth weight increases.

Logistic Regression Analysis:

This logistic regression analysis has analyzed that children, watching TV & playing video games for more than 3 hours and sleeping less than 10 hours are having statistical significant risk of being obese. These variables showed adjusted OR of >1 and p value <0.05 relating the variable to be a risk factor for obesity. Children with preferred foods being vegetables or fruits, long hours of outdoor play and occasional restaurant visits are identified as protective factors with statistical significance. The logistic regression table calculated was with adjusted OR <1 and p value <0.05. This states that these variables are the protective factors noted against obesity.

Strength of the study is BMI analyzed with IAP BMI Chart 2015 for Indian standards as per the recommendations of Indian Academy of Pediatrics, so that under diagnosing obese children in native region is averted.

Limitations of the study include fine detail errors in the sleep pattern, food habits and recollecting the birth weight might be possible because of poor parental recollection and a moderate sample size.

CONCLUSION

The Prevalence of Obesity among school children in Madurai is 9.3%. Comparing previous studies in Tamil Nadu it is on the rise. Prevalence of overweight among school children is 16.8%. The prevalence of obesity has strong association with the place of residence and socio-economic status. No correlation was noted between age and gender in relation to obesity, but there is an increase in Mean and Standard deviation of BMI as the age increases. Risk factors identified were sedentary lifestyle; unhealthy food patterns, sleep deprivation and birth weight and most of these factors are modifiable. Protective factors identified were to prefer fruits and vegetables for healthy diet, adequate physical activity and outdoor play and visiting restaurants rarely. Parental obesity showed no correlation to the prevalence of obesity in their children.

RECOMMENDATIONS:

1) Screening for obesity among school children is needed on a regular basis, so as to identify and intervene early.
2) Early diagnosis and life style modification has to be started in the childhood to prevent the epidemic of morbid obesity in adult life.
3) This study adds that prevalence of obesity among school children is 9.3% and overweight is 16.8% in Madurai, and modifiable factors are the commonest causative factor, hence early life style modification is of utmost importance to the native community.

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