

Study of Relation between Obesity and Early Onset of Puberty in Girls Aged between 9-12 Years from Hyderabad, India

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Abstract:

- **Objective:-** To determine the relationship between obesity and early puberty in girls aged 9-12 years.
- **Hypothesis:-** There is no significant relationship between obese girls and early puberty.
- **Type of Study:-** Survey type of school based cross-sectional studies carried for a period of 2 months.
- **Sample Size:-** 100 samples of school going girls within 9-12 years of age.
- **Methodology:-** Data was collected through a structured Questionnaire, Anthropometric measurements were recorded based on which BMI was calculated. Statistical tools like average mean, Standard deviation and one sample t- test were done to draw conclusion. Data was interpreted through tables, pie diagrams, graphs etc.
- **Results:-** A Total of 100 girls were involved, after screening, 60% girls were found to be obese. Out of these 60-sample size it was found that 46.6% obese girls attained early puberty whereas 23% normal and 30% underweight girls hit puberty at an early stage respectively.

Critical t-value of +/- 2.051 were obtained; hence the null hypothesis was rejected. From the findings it has been proved that higher percentage of obese girls attained early puberty whereas 30% underweight girls who also reached menarche at early age cannot be overlooked and needs further investigations. Suggestions to prevent obesity and lifestyle management is given to tackle this problem like Vitamin-D supplements, Increased physical activity, healthy eating habits and no stress. So that the age of menarche can be delayed for better health of the young girls in their future life.

Keywords:- Anthropometric Measurements, BMI (Body Mass Index), Obesity, Overweight, Underweight, Puberty, Menarche Precocious Puberty.

I. INTRODUCTION

According to WHO, obesity is defined as abnormal or excessive fat accumulation that may impair health. BMI provides the most useful population level measure of overweight and obesity as it is the same for both sexes and for all ages of adults.

In 2019, an estimated 38.2 million children under the age of 5 years were overweight or obese. As we all know that obesity is a major cause for many non-communicable diseases like diabetes, cardiovascular diseases, Varicose veins, breast cancer, sleep apnea, arthritis, etc. Like wise it has been found that obesity has adverse effects on puberty too.

In Recent studies it has been found that obese girls are more susceptible to accelerated pubertal growth. Puberty is the process of physical changes through which a child's body matures into an adult body capable of sexual reproduction. It is initiated by hormonal signals from brain to ovaries in a girl; In response to these signals, the ovaries produce hormones that stimulate libido, growth, development of bones, muscles, blood, hair, breast, and sex organs. Girls have more increase in body fat mass and Height during this period than boys. The major landmark for of puberty for girls is Menarche, the onset of menstruation, which occurs on an average between 12 – 13 years of age.

In 1950, the average age of the onset of puberty in girls was 13.1. In 1980 12.5 and in 2010 it dropped to 10.5 in U.S. The prevalence of Overweight/obesity among Indian children rose from 9.8% in 2006 to 11.7% in 2009. Lobstein and Jackson -Leach computed that there will be million obese children in India by 2025. The trouble is that this drop, which was expected to stop, has simply continued at the Same rate. According to Dr. Liji Thomas, MD Journal of Pediatrics, February 11, 2020, shows that, Over the last 40 years, the first sign of puberty in girls has come down by an average of 3 months per decade.

Puberty that starts earlier than usual is Known as Precocious puberty wherein the onset of first menstrual cycle About 8 years of age. Some possible complications of this are short height, social and emotional problems, obesity, CVD, irritability, cancer, depression, anxiety etc. This relentless side has begun to worry health care Professionals

who had proposed many etiologies to explain it. one of the major reasons for the above-mentioned Problem is said to be obesity along with faulty dietary habits like consumption of high fat, high sugar, processed foods accompanied with sedentary lifestyle. Apart the from this other important factor may include, environmental pollutants, adulterants in food and Vitamin- D deficiency.

In this survey an attempt has been done. to study any correlation between obesity and early puberty so that preventive measures can be proposed for the management of this current health issues with which we can ensure better health in future life to all young girls out there.

➤ *Aims and Objectives:*

- *Aim:-* To study the relation between BMI and Early puberty in young age girls (8-12 years) from Hyderabad, India.
- *Hypothesis:-* There is no significance relation between obese girls and early puberty.

➤ *Objectives*

- To record the BMI of young girls aged between 8-12 years.
- Screening of obese and overweight girls
- To calculate the percentage of obese girls who attained puberty at the age of 9-12 years.

➤ *Methodology*

Methodology is a significant part of any research study which gives research legitimacy and provides scientifically sound findings.

- *Methodology of the present study is discussed under the following heads.*

- ✓ Research design
- ✓ Selection of area
- ✓ Size of sample
- ✓ Data collection
- ✓ Data analysis

This is a school-based cross-sectional study carried out over a period of two months from Nov to Dec 2022.

➤ *Research Design*

Communicative study design of the study is in the following flow chart.

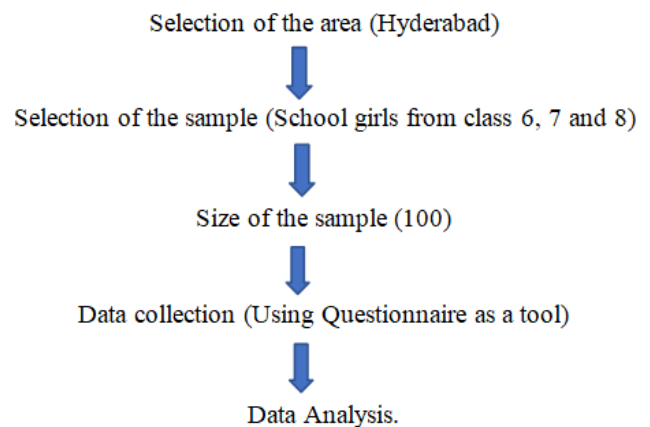


Chart 1 Communicative study design of the study

- *Research Approach:-* Communicative Study
- *Selection of Area:-* Study was done in Hyderabad city from India.
- *Selection of Sample:-* 100 Samples from a Reputed High School Girls were Collected.
- *Duration of the Study:-* The school based cross-sectional studies has been carried out for a period of about two months i.e., October and November 2022.
- *Collection of Data:-* The data was collected through a structured questionnaire which contains which contains questions related to age, height, weight, BMI, age of attaining puberty, food habits, lifestyle and about any hormonal disturbances.
- *BMI was used to define Overweight, Obese, Normal and Underweight. Three types of questions were including:*
 - Yes/No
 - Multiple choice questions
 - Open ended questions
- *Medium of language:-* English
- *Methodology:-* Responses of the questions were evaluated by percentage average and mean, and one sample t-test along with standard deviation. The data obtained was presented in the form of tables, pie diagrams and histograms.

The investigation followed survey type of descriptive research.

II. RESULTS AND DISCUSSIONS

From the total samples collected, the data was compiled, and statistical analysis was done. The results obtained are discussed below:

- *Percentage of Girls who Attained Puberty.*

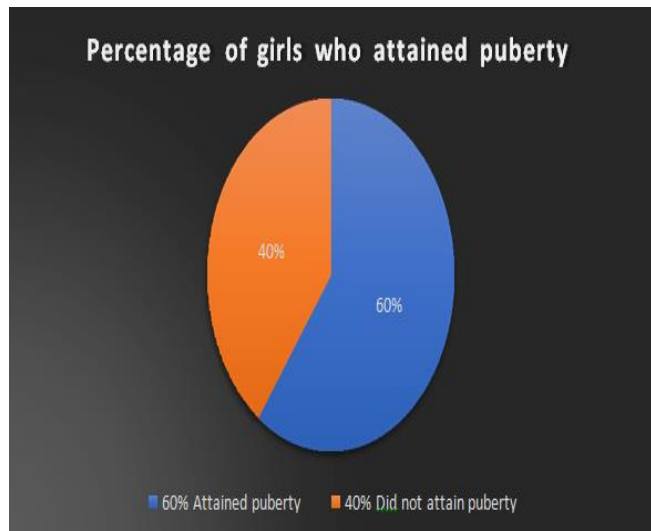


Fig 1 Percentage of Girls who Attained Puberty

➤ Discussion

From the above pie-diagram it can be interpreted that about 60% of the girls aged between 9-12 years attained puberty whereas the remaining 40% have not yet attained puberty.

Table 1 Distribution of 60 girls who attained puberty on basis of BMI into obese, normal, and overweight. In the present investigation sample consist of 60 girls who attained puberty categorized as obese, normal, and underweight on basis of BMI.

Type	No. of girls attained puberty	Percentage
Obese	28	46.6%
Normal	14	23%
Underweight	18	30%

➤ Distribution of Girls who Attained Puberty Based on their BMI.

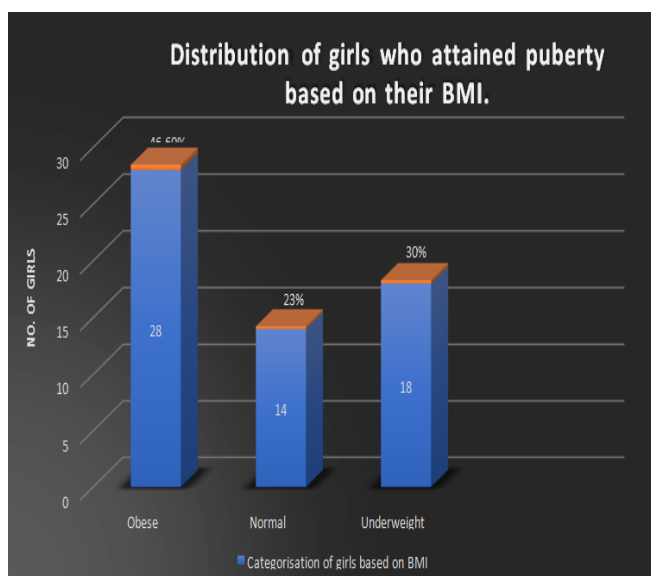


Fig 2 Distribution of Girls who Attained Puberty Based on their BMI

➤ Discussion

The above figure shows that 28 girls i.e., 46.6% out of 60 who attained puberty are found to be obese. 14 girls i.e., 23% have normal weight whereas 18 girls i.e., 30% are underweight.

Table 2 Distribution of Samples Based on Age and BMI

S.no/ no. Of obese girls	Age years and months	n- μ	BMI	n- μ
1	10.2	1.5	30	
2	10.3	1.4	26	1.6
3	10.5	1.2	26	1.6
4	10.7	1	26	1.6
5	11.1	0.6	27	0.6
6	11.4	0.3	25	2.6
7	11.6	0.1	25	2.6
8	11.6	0.1	26	1.6
9	11.6	0.1	27	0.6
10	11.6	0.1	27	0.6
11	11.7	0	28	-0.4
12	11.8	-0.1	28	-0.4
13	11.8	-0.1	28	-0.4
14	11.9	-0.2	28	-0.4
15	11.9	-0.2	28	-0.4
16	11.9	-0.2	30	-2.4
17	11.9	-0.2	30	-2.4
18	11.10	0.6	30	-2.4
19	11.10	0.6	26	1.6
20	12	-0.3	27	0.6
21	12.2	-0.5	30	-2.4
22	12.2	-0.5	31	-3.4
23	12.2	-0.5	28	-0.4
24	12.6	-0.9	28	-0.4
25	12.6	-0.9	28	-0.4
26	12.6	-0.9	28	-0.4
27	12.7	-1	27	0.6
28	12.7	-1	27	0.6

➤ Regression Analysis:-

From the above table the average mean of age calculated was

$$M = \frac{\text{sum of the variables}}{\text{Total number of variables}} = \frac{327.5}{28} = 11.7$$

Therefore, the average mean age of the obese girls found to attained puberty is 11.7 years.

Standard deviation: $\delta = \sqrt{1/N \sum_{i=1}^N (x_i - \mu)^2}$
 $\delta = 0.68945$

One sample t-test: $t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$

➤ Were

- Hypothesized mean $\mu = 2.1$ Sample mean $\bar{x} = 11.7$ Standard deviation = 0.689 t-statistic = 90.461 Degrees of freedom = 27

- Critical t – value (one tailed) =1.703 Critical t- value =+/- 2.0518
- With level of significance 5%
- The values obtained i.e., +/- 2.015 is greater than 0.05%. Hence the null hypothesis is rejected. Therefore, from the above calculation it can be proved that girls attained puberty at an early age.

➤ *BMI Calculation: - Average Mean of BMI*

$$M = \frac{\text{sum of the variable}}{\text{Total number}} = \frac{775}{28} = 27.6$$

Therefore, the average mean of BMI of the young girls who attained puberty is 27.6.

Standard deviation: - $\delta = \sqrt{1/N \sum (x_i - \mu)^2}$ $i=1$ $\delta=2.20$

One sample t- test: $t = \frac{\bar{x} - \mu}{S/\sqrt{n}}$ t – statistic =66.3
Degrees of freedom =27

Critical t-value (one - tailed) =1.7032 Critical t-value (two- tailed) = +/- 2.0518 Level of significance 5%

The value obtained is greater than 0.05%. Hence the null hypothesis is rejected. Now, it has been proved that obese girls attain puberty at an early age of about 9-12 years.

III. SUMMARY

➤ *Several theories have been found which explain the association between obesity and early puberty, few are mentioned below: -*

- According to Kaplowitz: Hormone Leptin plays an important role. Fat cells make leptin, hence the more the fat cells the more leptin in our bodies.
- This leptin is responsible for regulating appetite, body type, and reproduction. Enough leptin is responsible to trigger puberty.
- According to Wenyan Li, Qin Liu: Obesity is often accompanied by inflammatory reactions that increase the cytokines and promote the synthesis of androgen; such changes in androgens could precipitate early puberty.
- According to de Ridder et al: Obesity in children may lead to improvement of aromatase activity, which can accelerate the conversion of androgens to estrogens higher levels of estrogens in children tissues leads to early puberty.
- Apart from these theories, one more most important one is by Malathy Iyer, Times of India. As per these certain studies showed that Vitamin-D levels may be associated with precocious puberty. According to Endocrine society 95 Annual meeting in San Francisco, the researchers found that low levels of Vitamin-D were found in girls who attained precocious puberty.
- The research also found that Vitamin-D deficiency affected the hormonal cycle in such a way that it triggered the ovulation process. However, Vitamin-D tablets or injections could help delay early onset.

- Puberty in a girl's life is a time when she becomes sexually mature and the process usually starts around 10-14 years of age with early signs like breast development, oily skin, growth of pubic hair, acne and lastly menstruation. Normally menstruation starts two years after breast development, which is also known as Menarche.
- Since the beginning of 20th century, a gradual decline in the age of puberty has been observed. Recently from various studies it has been reported that overweight or obese girls attained menarche early when compared to those who are under normal range overweight or obesity in girls can be because of many factors like excessive use of junk food, sedentary lifestyle, faulty eating habits, Improper circadian rhythms, stress etc. Hence a small survey research has been done to find any association between them.

IV. CONCLUSION

In conclusion, the present study reveals that the mean age of menarche in obese / overweight about 46.6% of the total sample attained menarche at an average mean age of about 11.7 years. From the various studies and few theories mentioned above it has been found that obesity (which can be due to any reason) has a major impact on early menarche in girls. This is now a major health concern, whereas it has also been found that around 30% girls from the sample were found to be underweight who also attained early menarche.

Hence likewise a detailed study on the relation between underweight and early puberty deserves further studies.

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RECOMMENDATIONS AND SUGGESTION

Early puberty can be avoided if parents can ensure to provide a healthy diet, active lifestyle, proper sleep, or circadian rhythms, stress free lifestyle, no junk food for at-least 7 years of age, encouraging physical activity, Vitamin-D supplementation, or exposure to early sunshine; if allowed rigorously all these simple measures may help delay puberty.

More health programs, awareness in society targeting regarding proper healthy eating on time, must be organized along which the risk health factors of early puberty must be discussed.

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