Original Article

ASSOCIATION OF AGE OF MENARCHE WITH BODY MASS INDEX AND WAIST-HIP RATIO IN SCHOOL GOING GIRLS

Prerna Pandey[1], Nivedita Sirdesai[2]*, Hetal Rathod[3]

[1] MBBS, Student, Dr D Y Patil Medical College, Hospital and Research Centre, Dr D Y Patil Vidyapeeth, Pimpri, Pune-18.
[2] Assistant Professor, Dept. of Physiology, Dr D Y Patil Medical College, Hospital and Research Centre, Dr D Y Patil Vidyapeeth, Pimpri, Pune-18.
[3] Professor, Dept. of Community Medicine, Dr D Y Patil Medical College, Hospital and Research Centre, Dr D Y Patil Vidyapeeth, Pimpri, Pune-18.
Corresponding Author: Nivedita Sirdesai, Assistant Professor, Dept. of Physiology, Dr D Y Patil Medical College, Hospital and Research Centre, Dr D Y Patil Vidyapeeth, Pimpri, Pune-18.
Email: dr.sirdesai.nivedita@gmail.com

DOI: 10.47750/pnr.2023.14.02.207

Abstract

Background and Objectives: Age of Menarche is affected by various genetic (sex, race, parental influence), environmental (body fatness, nutrition) and socioeconomic/cultural factors (e.g., immigration status). In this study, we have analysed association of age of menarche with BMI, WHR, parent's education and occupation.

Materials and Methods: The study included 72 girls who had attained menarche during the study or within six months prior to the study. Their primary details (name, age) time of menarche, parent education and occupation were collected using questionnaires, height (in cm) and weight (in kg) were measured. BMI and WHR was calculated and analysis was done by Epi Info 7 software.

Results: When comparing private and government school for mean age of menarche it was found that the mean menarche age in high WHR was lower in private school. So, there must be some other confounding factors responsible for lower age of menarche in private school. In the government school, the mean age of menarche was almost similar in BMI categories. However, in private school underweight girls were found to have lower mean age of menarche. Overall, Mean age of menarche of private school was lesser than government school girls. No correlation was found between mean age of menarche and parents education and occupation.

Conclusion: There was positive correlation between anthropometric measurements and age of menarche. Howerver, all are weak correlations.

Keywords: BMI, Menarche, Waist Hip Ratio.

Introduction

Puberty is a phase of life during which our body goes through many biological, physical, psychological, and social changes and prepares itself for reproduction. Although it's a universal phase, the timing of attaining puberty is different for each individual due to genetic (e.g., sex, race, parental influence), environmental (e.g., body fatness, nutrition), and socioeconomic/cultural factors (e.g., immigration status)[1]. For example, girls generally attain puberty between 10-14 years of age whereas age of attaining puberty in boys is between 12-16 years[2]. Menarche

is the onset of menstruation. It generally marks the beginning of puberty in girls[3]. It is considered as a distinct benchmark for sexual maturation. It can also be used as an indicator of quality of life of a population as it is influenced by a number of biological and socio-economic factors [4].Menarche is one of the important sign to major the fertility of a female which includes the period up to menopause. There are a lot many researches going on to relate the age of menarche with different physical body parameters such as height and weight; however, there is a variation on the role of such factors. Some researchers even believe that a minimum body weight is required to attain menstruation, that a girl should have some body fat for a healthy start of their reproductive life. A major factor which is leading towards the decline of the age of menarche is higher food consumption which is often a result of the improved socio-economic factors[5]. So the socio-economic factor also plays a very important role in determining the age of menarche along with the other physical body parameters. Various studies show that it either leads to the early or very late onset of puberty[6]. But again not many research have been conducted relating the waist hip ratio with the age of menarche. It has only been studied that a lower waist hip ratio indicates a healthy reproductive life of a female. [7]

Objectives:

The aim of this research it to correlate the age of menarche with different physical parameters such as body mass index and waist-hip ratio in school going girls and also with their parent's education and occupation.

Materials and Methods

After approval from the Ethical Committee of the Institute, permission letters from the schools were taken to carry out the research. The study included 210 girls out of which only 72 had attained menarche within six months prior to the study or during the study. The study was explained to the teachers of the schools a week prior to conduction and visit for data collection with regards to anthropometric measurements was scheduled in conjunction with school curriculum. Consent form informing the aim and methodology of the research to parents in Marathi and English were distributed to all the girls of the selected schools of age between 10-16 years few days prior to the data collection. A cross sectional study was conducted including all the girls whose parents gave consent for the study. Girls within the age group of 10-16 years and who have attained menarche six months before to at the time of study were included in the study. Girls with a history of a chronic illness, congenital heart disease, diabetes were excluded from the study.

The details like name, age, time of menarche, parent education and occupation, and health history were collected using questionnaires, general health examination was done. Height (in cm) and weight (in kg) were measured to the nearest 0.1 cm and 0.5 kg respectively. BMI was calculated as weight (kg) divided by the square of height (m^2). Waist circumference was measured at the midpoint between the inferior margin of the last rib and the top of the iliac crest. Hip circumference was measured at the largest posterior extension of the buttocks. Waist and hip circumferences was measured to the nearest 0.1 cm. The waist-to-hip ratio was calculated using the formula,

WHR = waist circumference (cm) / hip circumference (cm).

All the data were formulated in an excel sheet and then a detailed results were obtained.

Statistical Analysis:

Data from both the schools was entered in Microexcel software and analysis was done by Epi Info 7 software (7 version) and MedCalc (version 19.1). Spearman coeffecient of rank correlation and Pearsons correlation coefficient was applied based on normal distribution of data. Comparison of correlation was done between private and government school between the anthropometric parameters and mean menarchal age.

Results

Table 1 Association of mean age of menarche with WHR and BMI in private and government school

Type of School		Private English School (N = 30)		Govt. Corporation School (N = 42)	
		Frequency Percentage (%)	Mean Age of Menarche (years) (SD)	Frequency Percentage (%)	Mean Age of Menarche (years) (SD)
WHR classification	HR	17 (56.67)	12 (1.11)	28 (66.67)	13.39 (1.03)
	N	13 (43.33)	11.76 (1.16)	14 (33.33)	13.14 (0.66)
BMI classification	Normal	11 (36.67)	12.1818 (0.87)	14 (33.33)	13.5714 (0.75)
	Overweight	03 (10.00)	12.0000 (1.00)	00 (00.00)	NA
	Underweight	16 (53.33)	11.6875 (1.30)	28 (66.67)	13.1786 (0.98)

The waist hip ratio was classified into 2 types : Normal WHR ≤ 0.80cm (N) and High risk ≥ 0.80cm (HR). In private school the mean age of menarche in HR WHR group was 12 and normal group was 11.76 years. In government school the mean age of menarche in HR WHR group was 13.39 and normal group was 13.14 years. When comparing private and government school for mean age of menarche it was found that the mean menarche age in high WHR was lower in private to government. So, there must be some other confounding factors responsible for lower age of menarche in private school. The body mass index was classified into three types : normal, overweight and underweight. Private school in our study had normal, overweight as well as underweight girls whereas government school had only normal and underweight girls. The mean age of menarche in normal BMI group was 12.1818, in overweight group was 12.0 and in underweight group was 11.68. The mean age of menarche in normal weight group was 13.5714 years whereas in the underweight group was 13.1786 years. In the government school, the mean age of menarche was almost similar in BMI categories. However, in private school underweight girls were found to have lower mean age of menarche. Correlation between mean age of menarche with mother's education, mother's occupation, father's education and father's occupation was also studied. No correlation was found between mean age of menarche with parents education and parents occupation in our study.

Table 2 Mean age of menarche in private and government school

	Observation	Mean age of menarche (years)	SD
Private school	30	11.9	1.1250
Government school	42	13.3	0.9236

$t = 5.83$, $df = 70$, $p = 0.0001$

Overall mean age of menarche irrespective of their anthropological classification in private school was 11.9 years as compared to 13.3 years in government school. Mean age of menarche of the entire study population was 12.722 (SD 1.2244) with the minimum age being 10 years and maximum age being 15 years and most common age of attaining menarche was 13 years.

Table 3 Correlation between BMI and WHR with age of menarche

Variable	Sample size	Correlation Coefficient (rho)	P value
WHR with age	72	0.12*	0.3086
BMI with age	72	0.08**	0.4884

* Spearman coeefeicient of rank correlation

** Pearsons correlation coefficient

BMI and WHR with age of menarche is having very weak positive correlation.

Table 4 Correlation analysis in private and government school

Variables		Private English School (N = 30)	Govt. Corporation School (N = 42)	Z statistics	P value
Body Height	r value	0.3333	0.2226	0.4760	0.6341
Body Weight	r value	0.3671	0.2399	0.57	0.5687
BMI	r value	0.2994	0.1218	0.7109	0.4771
WHR	r value	0.07942	0.06634	0.04011	0.9680

Correlation was applied for Body Height, Body weight, Body Mass Index and Waist hip ratio for both the schools, showed weak correlation in this regard.

Discussion

The waist hip ratio was classified into 2 types : WHR ≤ 0.80cm (N) and High risk ≥ 0.80cm (HR). When comparing private and government school for mean age of menarche it was found that the mean menarche age in high WHR was lower in private school. So, there must be some other confounding factors responsible for lower age of menarche in private school. Overweight students were not found in government school. In the government school, the mean age of menarche was almost similar in BMI categories. However, in private school underweight girls were found to have lower mean age of menarche highlighting pivotal role of adequate and balanced nutrition in attaining puberty. Tanwir et al. have demonstrated an inverse association between age at menarche and obesity or overweight.[4] Mean age of menarche of private girls is lesser than that of government school which had a overall tendency towards late menarche. The differences in the mean age of menarche in both the schools can be attributed to their eating habits, nutritional status, effect of affluence or socioeconomic well being. Similar studies have also documented fall in the age of menarche making young girls more vulnerable to potential hazards of sexual abuse, unprotected sexual activity etc. This highlights the immense role of parents, family and community at large in the appropriate development of adolescents.[9] A study on physical growth and relation of menarche with anthropometry has also concluded under nutrition affecting the age if menarche and higher anthropometric girls experience early puberty.[10] The association of age of menarche with father's education, mother education, father's

occupation and mother's occupation was studied for both the schools, no significant statistical correlation was found. Correlation was applied for Body Height, Body weight, Body Mass Index and Waist hip ratio for both the schools, showed no strong correlation in this regard. Studies by Prarthana et. al. also could not draw any significant correlation between age at menarche and BMI as well as waist-hip ratio suggesting multifactorial effect on age of menarche. [11]

Conclusion:

There was positive correlation between anthropometric measurements and age of menarche. Howerver, all are weak correlations. Timing of menarche is influenced by many different factors in different society. Here we found no statistically significant result which can be the ruling factor for the age of attaining menarche suugesting role of other factors on the onset of menarche. Puberty is a stage of gonadal development and maturation to a point where reproduction is possible for the first time. Female pubertal events are characterized by adrenarche (increase secretion of adrenal androgens), thelarche (breast bud appearance), pubarche (axillary and pubic hair appearance) followed by menarche (menstruation starts). Menarche is central milestone of female puberty as it signals the possibility of fertility. Studies carried out worldwide in different populations have concluded a decline in the average age of menarche over the last century. Onset of puberty is also governed by visual, external, olfactory and other sensory stimuli leading to awakening of hypothalamus. Puberty is a result of integrated function of Hypothalamo-pituitary-gonadal axis. Onset of menarche is under the influence of several factors like nutritional status, genetic factors, environmental factors. Childhood obesity as well as physical inactivity in childhood reflected as an increase in BMI, WHR is associated with early menarche. Environmental factors like chemicals, pollutants, BPA in plastic also affect the age of menarche. Consumption of animal protein in diet, high fatty food also cause early menarche. Hence it is advised to inculcate healthy food habits, avoiding usage of plastic, avoiding cosmetic usage, monitor weight during adolescence and puberty.

Summary:

There was correlation between anthropometric measurements and mean age of menarche in both the schools. However all are weak correlations.

Limitations of study:

Our study could not produce statistically significant results in anthropological parameters owing to our restricted study population and sample size. There is scope to conduct a larger survey as well as study on association of age of menarche in a mother and daughter relationship.

Acknowledgement:

We would like to show our gratitude to the Indian Council of Medical Research- Short Term Studentship (ICMR-STS) for giving us the opportunity to carry out this research project.

Conflicts of Interest:

Nil

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