



Influence of Physiological Variables and Psychosocial Factors on the Onset of Menarche in Schoolgirls of Pakistan

Hamna Mukhtar Tarar*

Department of Central Sterile Supply, University of the Punjab, Lahore, Pakistan

*Corresponding Author: Hamna Mukhtar Tarar, Department of Central Sterile Supply,
University of the Punjab, Lahore, Pakistan

E-mail: hamna_tarar11@yahoo.com

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ABSTRACT

Purpose: To determine the impact of physical and psychosocial factors on the age of menarche in girls from different socioeconomic backgrounds in Karachi, Pakistan.

Methodology: A cross-sectional study was carried out on female students aged 11 to 16 years from four different schools in urban and rural areas of Karachi district, Pakistan in 2022. Subjects who had not yet menstruated were excluded. Bilingual questionnaires were used in the study to record the responses. Height and weight were measured using calibrated instruments. The population sample size was 307, with a 95% confidence level. The Kuppusswamy scale was used for Socioeconomic Status (SES) measurement.

Results: The mean age of menarche was found to be 11.9 ± 1.1 years. The study showed a significant correlation between age at menarche and height ($p=0.000$), weight ($p=0.001$), BMI ($p=0.009$), physical activity ($p=0.007$), female siblings ($p=0.082$), psychological effect of lockdown ($p=0.035$), father's occupation ($p=0.002$) and abusive home environment ($p=0.015$). Diet, co-education, relation with father, total number of siblings, paternal presence or absence and socioeconomic status showed insignificant correlation with age at menarche. Various factors, particularly emotional abuse, can have far-reaching effects on the growth and development of female adolescents.

Conclusion: The results support the significant influence of height, weight, BMI, physical activity, father's occupation, and abusive home environment on age at menarche.

Keywords: Menarche, Physiological, Psychological, Social, Women's health

INTRODUCTION

The first menstrual cycle, or menarche, occurs when a female reaches sexual maturity and signifies her passage from infancy to adulthood. Menstrual age is influenced by genetics, race and physical characteristics such as Body Mass Index (BMI).

Shirazi and Rosinger concluded a significantly lower age of menarche by about 4.3, and 3.2 months, respectively, of Non-Hispanic (NH) black and Hispanic girls relative to NH white girls when lifestyle and physiological factors were taken into account. The mean age at menarche in France has also decreased from 12.78 years in 1979 to 12.6 years in 1994, although it has recently stabilized at 12.5 years \pm 0.08 years by Lalys and Pineau. Meanwhile, the mean age of menarche among Indo-Pakistani girls was found to be 13.06 years according to Ulijaszek, et al.

In a previously published extensive review of ages at menarche across the world of 67 countries, a huge variability was

observed while some sources suggest a decline in menarcheal age, Papadimitriou reports an advanced trend along the years. However, Pakistan lacks data about the topic as people are reluctant to talk about menarche due to cultural norms. Karim, et.al conducted a study between 2015 and 2017, to determine the age of menarche and its association with the growth status of 8 years-16 years old schoolgirls of the province of Punjab province of Pakistan. Another study was conducted in 2014 on school-going girls of Karachi to determine the effect of media and nutrition.

The purpose of this study was to determine the present age of menarche for Pakistani girls under the influence of various physiological variables and psychosocial factors. Thus, the study aimed to correlate age at menarche with factors like abuse, home environment, body mass index, parents' qualifications and occupation, nutrition, socioeconomic status, COVID-19 lockdown, physical activity and psychological factors [1].

LITERATURE REVIEW

A cross-sectional study on public and private schoolgirls from the city of Karachi, selected at random was carried out, after approval by the Altamash Institutional Review Board (IRB) at Altamash dental institute. The calculated sample size was 307, with a 95% confidence interval. Girls who had reached menarche were included in the study [2].

A questionnaire was disseminated among middle and high school girls and results were collected from March to July 2021. To improve convenience and enable a better understanding of the questions, the questionnaire provided an option to answer in one of two languages (English or Urdu). Roughly 386 responses were received of which 307 which met our inclusion criteria were chosen for data evaluation [3].

The screening questionnaire included the child's age, class and section, name of the school, an informed consent for participating in this study which was to be signed by the student as well as the student's date of menarche along with questions on associated factors. Socio-demographic profiles included education level, occupation and monthly income of both parents, number of siblings, nutrition, the social environment at home, stress levels during the menstrual cycle and whether they were living in an extended family system or not. Socio-economic Status (SES) was determined by using the modified Kuppaswamy scale [4].

Date of the menarche was asked for the subject by the "recall method". Height and weight measurements were done on spot using a weighing balance and a measuring tape. The psychological stress levels were measured using APA LEVEL 2-Anxiety-Child Age 11-17 (Promise emotional distress-pediatric Item bank). COVID-19 lockdown was also taken into consideration while assessing distress levels. Raw score was used to calculate T-score for each individual. They were then classified into four groups based on severity level. SPSS version 25 was used for data analysis. ANOVA and *Chi-square* tests were used to find the correlation between different factors and their influence on menarcheal age [5].

RESULTS

This study included a total of 307 participants between ages 11 and 16 in the 4 schools from which data was collected. The mean age of menarche was noted as 11.93 ± 1.086 [6].

Among the physical factors, our study showed a significant correlation between BMI and age at menarche ($p=0.009$). The mean BMI in our study population was calculated to be 18.7 kg/m^2 with the lowest being 10.0 and the highest being 40.0. Table 1 shows the mean values for age, weight, height and BMI. Effect of BMI as well as with socioeconomic status on menarche was also found to be statistically significant. Our study also found that girls with a higher weight and a longer height and by extension a higher BMI were more likely to undergo menarche later. Additionally, the mean population BMI (x) was found to have a statistically significant association with socioeconomic status [7].

Physical activity also showed a significant correlation with the age at menarche ($p=0.031$). Detailed descriptives of physical activity are given. Chart 1 shows relationship of physical activity with age at menarche. A significant correlation was found between monthly income and diet ($p \text{ value}=0.007$), however, it showed no significant relation with the age at menarche. Moreover, no significant relation was found between age at menarche and a few factors *i.e.*, co-education, relation with father, paternal presence or absence and intake of medicines [8].

SES also showed no effect on the age at menstruation. Chart 2 shows its relationship with age at menarche. The effect of the lockdown in the wake of COVID-19 was also assessed. 43.6% of the girls reported having gotten lazy due to the lockdown while 38.4% of girls reported more level of annoyance sometimes post quarantine. The results of the ANOVA analysis show that the significance value is 0.508 ($p=0.508$), which is greater than 0.05 so we conclude that there is a no statistically significant difference between the ages with respect to socioeconomic class. Frequencies of SES, physical activity and home environment are shown [9].

Among psychosocial factors, a significant relationship between social environment at home and the onset of menarche was reported ($p < 0.05$). Chart 3 shows relationship of home environment with age at menarche. A disturbed home environment showed a 100% chance of early menarche while a secure environment had a 67.5% chance of early menarche. Moreover, the highest percentile (29.4%) of emotional abuse was found in a disturbed home environment. The abuse was also found to be associated with intense psychological effects during the lockdown. Upon further analysis association between father's literacy and emotional abuse were found to be statistically significant ($p < 0.01$). Father's occupation was found to be having significant relationship with psychological effects during lockdown ($p < 0.01$). And presence of female siblings has also shown an impact ($p < 0.01$). Detailed descriptives of home environment are given [10].

The scores of emotional distress showed no significant results, therefore suggesting that emotional distress experienced during menses had no relation with the age of onset of menarche. However, stress experienced during menses showed significant relation with abuse ($p < 0.01$) [11].

DISCUSSION

Menarcheal age is considered an important indicator of pubertal development in girls. Several factors have been discussed here asserting an impact on age at menarche. In this study, BMI showed a strong correlation with the onset of menarche as in prior evidences. Body weight, height, BMI, supra iliac, and abdominal skinfolds have been shown to have a strong impact on early menarche. Different theories suggest different explanations such as leptin protein from body fat, shorter height in girls due to earlier closure of epiphyseal plates and increase in estrogen hormones in girls attributing to variation in menarcheal age [12].

This study also showed that a high protein diet has no significant relation with age at menarche. A correlation however exists between dietary energy intake and carbohydrates and iron intake on the menarcheal age. On the contrary, Abioye-Kuteyi, et al., showed that earlier onset of menarche was reported in girls who have a high protein diet intake. It is well known that undernutrition delays the onset of menarche [13].

This study has shown that physical activity less than 30 minutes per day or more than 60 minutes per day are associated with a higher mean age of onset of menarche. Associations have been reported for girls with high physical activity with a later age of reaching menarche. Low exercise has been observed as associated with late menarche whereas if the low activity is related to obesity and higher BMI, then it leads to an earlier onset of menarche. This may be due to an ovulatory cycles due to increased energy expenditure, hypothalamic dysfunction or changed hormonal levels in blood [14].

No significant correlation was found between onset of menarche and SES. It is comparable to previous studies. However contrarily, Hiatt showed a weak association between lower SES with earlier onset. Whereas Behel and Raje that used the similar scale reported in aforementioned study, a correlation between higher ages of onset with lowers SES. These differences may stem from the fact that they have all used different parameters to calculate SES. A standardized system for measuring socioeconomic status may resolve this issue [15].

It is earlier reported that a father's education is associated with earlier menarche. Similarly, father's occupation has also been observed as having strong impact on the menarcheal age of girls. They are all in agreement with this research which showed a significant effect of a father's education and occupation on menarcheal age. This may be due to reduced stress in the family and home environment due to a sense of security [16].

This research shows a strong correlation between stress including abuse and disturbed home environment as in other studies where family disruption and family stress are associated with earlier onset of menarche. This has been explained by Belsky as the psychosocial acceleration phenomenon and high cortisol levels in response to psychosocial stress and probably the activation of reproductive centers which is still being investigated. Physical abuse speeds up the maturation process [17].

This study has shown that psychological factors have no effects on the age of menarche. However Jimenez, et al. has recently shown that precocious puberty is related to the impact of COVID-19 as depression, anxiety, and stress levels were seen to increase during the lockdown. Enough data is not available which compares the COVID-19 lockdown and its effects on age at menarche [18,19].

CONCLUSION

The results support the significant influence of height, weight, BMI, physical activity, father's occupation, and abusive home environment on age at menarche. Socioeconomic status and other factors evaluated do not show any correlation with age at menarche. More groups may be sampled for even better outcomes of a study of this sort.

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