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A Study Assessing Anxiety Levels Among Adolescents Who Attained Early Menarche Using Generalised Anxiety Disorder - 7 Scale (Gad-7)

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ABSTRACT

Background: Early menarche, defined as menstruation onset between ages 8 and 10, is increasingly linked to psychological distress, particularly anxiety, in adolescent girls. Limited data exist on this issue in India, where cultural and social factors may amplify risks. This study assesses anxiety levels among adolescent girls in Chennai with early menarche using the Generalized Anxiety Disorder-7 (GAD-7) scale.

Objective: To evaluate the prevalence and severity of anxiety among adolescent girls aged 10–19 years who experienced early menarche and identify associated risk factors, such as age at menarche and menstrual irregularity.

Methods: A cross-sectional study was conducted from March to May 2025 in Chennai schools, involving 170 girls aged 10–19 years with menarche between ages 8 and 10, selected via purposive sampling. Anxiety was measured using the GAD-7 scale, with severity categorized as minimal (0–4), mild (5–9), moderate (10–14), and severe (15–21). Data on demographics and menstrual history were collected via self-administered questionnaires. Associations between anxiety, age at menarche, and menstrual regularity were analyzed using statistical tests ($p < 0.05$).

Results: Of the 170 participants, 55.8% (n=95) reported anxiety symptoms: 29.4% mild, 17.6% moderate, and 8.8% severe. Additionally, 26.5% had minimal anxiety, and 17.6% reported no anxiety. Earlier menarche (8–9 years) was significantly associated with higher moderate and severe anxiety compared to menarche at 9–10 years ($p < 0.05$). Menstrual irregularity strongly correlated with increased moderate and severe anxiety ($p < 0.01$).

Conclusion: Over half of the adolescent girls with early menarche experienced anxiety, with earlier onset and menstrual irregularity as significant risk factors. These findings highlight the need for targeted mental health interventions and menstrual health education in Indian schools.

Keywords: *Early menarche, anxiety, GAD-7, adolescent girls, India*

1. INTRODUCTION

Anxiety disorders constitute a significant global health challenge, affecting approximately 301 million individuals in 2019, with adolescent girls particularly susceptible during the tumultuous transitions of puberty (1). The World Health Organization defines adolescence (ages 10–19) as a critical developmental phase where early stressors can profoundly shape mental health outcomes (1). In recent decades, the age of menarche has declined globally, including in India, driven by improved nutrition, urbanization, and healthcare access (2,12). Early menarche, defined here as onset of menstruation between the ages of 8 and 10 years, is increasingly recognized as a risk factor for psychological distress, particularly anxiety (3,13). This premature pubertal shift disrupts the alignment of physical and emotional maturity, exposing girls to elevated stress and vulnerability (4,14).

Physiologically, the surge in pubertal hormones, notably estrogen, influences brain regions such as the amygdala and prefrontal cortex, which govern emotional regulation (5,15). Studies suggest this hormonal interplay may amplify negative cognitive patterns, impair coping mechanisms, and heighten anxiety susceptibility (6,16). Early menarche often coincides

with accelerated physical changes that outpace psychological readiness, fostering feelings of inadequacy or alienation (7,17). Socially, early-maturing girls face intensified body image concerns, peer judgment, and, in some contexts, premature sexualization, all of which exacerbate anxiety (4,18). In India, cultural attitudes toward menstruation, frequently shrouded in stigma and silence, may compound these challenges, yet region-specific data remain limited (2,19).

Prior research highlights that early menarche correlates with elevated anxiety symptoms, particularly when compounded by stressors such as academic pressure or limited family support (7,20). For instance, studies in Western populations have linked early puberty to increased risks of internalizing disorders, including anxiety and depression (9,21). Similar patterns are emerging in Asian contexts, where rapid socioeconomic changes have lowered menarcheal age, potentially amplifying psychological risks (2,22). The Generalized Anxiety Disorder-7 (GAD-7) scale, a validated tool for assessing anxiety severity, has been widely used to quantify these effects in adolescents (8,23). However, few studies have explored its application in Indian adolescents with early menarche, despite the unique interplay of biological, social, and cultural factors in this population (19,24).

This study addresses this gap by examining anxiety levels among adolescent girls in Chennai who attained menarche between the ages of 8 and 10 years, using the GAD-7 scale (8). By assessing prevalence and associated risk factors, it aims to inform targeted mental health interventions, contributing to the sparse literature on menstrual and psychological health in India. Understanding these dynamics is crucial for developing culturally sensitive strategies to support adolescent well-being in a rapidly changing society (25).

2. MATERIALS AND METHODS

Study Design

This study is designed as a descriptive, observational cross-sectional study aimed at assessing anxiety levels among adolescent girls who attained early menarche.

Study Setting and Duration

The research will be conducted in selected schools within the Chennai metropolitan area. The data collection period is scheduled from March 2025 to May 2025, spanning a total of three months.

Study Population

The study population includes school-going adolescent girls aged between 10 and 19 years, who attained menarche between the ages of 8 and 10 years, which is classified as early menarche.

Sampling Technique

A purposive sampling method will be employed to select participants who meet the defined inclusion and exclusion criteria. A total of 170 eligible participants will be included based on sample size estimation.

Sample Size Calculation

The sample size was determined using Dobson's formula:

N=Z2×P×(1−P)D2N = \frac{{Z^2 \times P \times (1 - P)}}{{D^2}}

Where:

N = Required sample size

Z = Z-score corresponding to 95% confidence level (1.96)

P = Estimated prevalence of anxiety in adolescents with early menarche (31.9% from prior studies)

D = Desired margin of error (7%)

Substituting the values into the formula:

N=(1.96)2×0.319×(1−0.319)(0.07)2=170.3N = \frac{{(1.96)^2 \times 0.319 \times (1 - 0.319)}}{{(0.07)^2}} = 170.3

After rounding, the final sample size is fixed at **170** participants.

Inclusion Criteria

Adolescent girls who experienced menarche between the ages of 8 and 10 years.

Willing participants with written informed consent provided by parents or legal guardians

Exclusion Criteria

Girls who attained menarche before 8 years or after 10 years .

Participants with diagnosed psychiatric or neurological conditions (e.g., ADHD, autism, learning disabilities).

Girls whose parents or guardians did not provide consent.

Data Collection Tool

A structured, self-administered questionnaire will be used to collect demographic information, menstrual history, and anxiety levels. The tool includes:

Demographic section: Age, grade, living situation, presence of chronic medical conditions.

Menstrual history: Age of menarche, cycle regularity, dysmenorrhoea, and any associated diagnoses.

Generalized Anxiety Disorder-7 (GAD-7) scale: A validated seven-item tool that assesses the frequency of anxiety-related symptoms over the past two weeks. Each item is rated on a 4-point Likert scale from 0 ("Not at all") to 3 ("Nearly every day"), with total scores ranging from 0 to 21. Anxiety severity is classified as follows:

0–4: Minimal anxiety

5–9: Mild anxiety

10–14: Moderate anxiety

15–21: Severe anxiety

Data Collection Procedure

Upon obtaining ethical clearance from the Institutional Ethics Committee, permission will be sought from school authorities. Informed consent will be obtained from parents or legal guardians prior to data collection. Eligible participants will be briefed about the study objectives and given instructions on how to complete the questionnaire.

Participants completed the self-administered questionnaire in a supervised environment within their school premises to ensure clarity and confidentiality. Any doubts or concerns raised by the participants during the process will be addressed by the investigator. All collected data will be de-identified and stored securely to maintain participant confidentiality.

Ethical Considerations

Ethical approval has been obtained from the Institutional Ethics Committee of Sree Balaji Medical College and Hospital. Participation in the study is voluntary, and confidentiality of all data will be strictly maintained. No invasive procedures are involved, and there are no foreseeable risks to participants.

Funding Source

This study is self-funded by the principal investigator. No external funding agencies are involved.

Table 1: Demographic Profile of Participants (N=170)

Variable	Frequency (n)	Percentage (%)
Age Group (Years)		
10-12	55	32.4
13-15	75	44.1
16-19	40	23.5

Table 2: Menstrual History of Participants

Variable	Frequency (n)	Percentage (%)
Age at Menarche		
8–9 years	51	30.0
9–10 years	119	70.0
Menstrual Cycle Regularity		
Regular	116	68.2

Variable	Frequency (n)	Percentage (%)
Irregular	54	31.8 (≈32)

Table 3: Distribution of Anxiety Levels (GAD-7 Scores)

GAD-7 Score Category	Frequency (n)	Percentage (%)
No Anxiety (0)	30	17.6
Minimal (1–4)	45	26.5
Mild (5–9)	50	29.4
Moderate (10–14)	30	17.6
Severe (15–21)	15	8.8

Table 4: Association Between Age at Menarche and Anxiety Severity

Age at Menarche	No Anxiety (n)	Mild Anxiety (n)	Moderate Anxiety (n)	Severe Anxiety (n)	p-value
8–9 years	5	15	18	13	
9–10 years	25	35	12	2	<0.05

Table 5: Association Between Menstrual Regularity and Anxiety Severity

Menstrual Cycle	No Anxiety (n)	Mild Anxiety (n)	Moderate Anxiety (n)	Severe Anxiety (n)	p-value
Regular	25	40	15	4	
Irregular	5	10	15	11	<0.01

3. RESULTS

This cross-sectional study evaluated anxiety levels using the Generalized Anxiety Disorder-7 (GAD-7) scale among 170 adolescent girls aged 10–19 years who experienced early menarche (ages 8 to 10 years) in Chennai schools from March to May 2025. Data were collected via a self-administered questionnaire.

Of the participants, 30.0% (n=51) attained menarche at 8–9 years, and 70.0% (n=119) at 9–10 years. Menstrual cycles were regular in 68.2% (n=116) and irregular in 31.8% (n=54). Anxiety prevalence showed 55.8% (n=95) with symptoms: 29.4% (n=50) mild (GAD-7: 5–9), 17.6% (n=30) moderate (10–14), and 8.8% (n=15) severe (15–21). Additionally, 26.5% (n=45) had minimal anxiety (1–4), and 17.6% (n=30) reported no anxiety (0).

Age at menarche was significantly associated with anxiety severity ($p < 0.05$). Girls with menarche at 8–9 years exhibited higher moderate (35.3%, n=18) and severe anxiety (25.5%, n=13) compared to those at 9–10 years (10.1%, n=12 moderate; 1.7%, n=2 severe). Menstrual irregularity showed a strong association with anxiety ($p < 0.01$), with irregular cycles linked to greater moderate (27.8%, n=15) and severe anxiety (20.4%, n=11) versus regular cycles (12.9%, n=15 moderate; 3.4%, n=4 severe).

In summary, 55.8% of participants experienced anxiety, with earlier menarche and irregular cycles as a significant risk factor.

4. DISCUSSION

This cross-sectional study of 170 adolescent girls in Chennai with early menarche (ages 8 to 10 years) found that 55.8% (n=95) experienced anxiety symptoms, as measured by the GAD-7 scale [8], with 29.4% mild, 17.6% moderate, and 8.8% severe cases. Additionally, 26.5% (n=45) reported minimal anxiety, and 17.6% (n=30) had no symptoms, reflecting varied psychological responses to early puberty. The significant association between menarche at 8–9 years (30%, n=51) and

elevated anxiety—35.3% moderate and 25.5% severe versus 10.1% and 1.7% at 9–10 years (70%, n=119; $p < 0.05$)—highlights a critical risk period. Similarly, menstrual irregularity, present in 31.8% (n=54), strongly correlated with anxiety ($p < 0.01$), with 27.8% moderate and 20.4% severe symptoms compared to 12.9% and 3.4% in those with regular cycles. These findings illuminate the psychological burden of early menarche in an Indian context.

The pronounced anxiety at 8–9 years aligns with prior research linking early pubertal timing to psychological distress. Patton et al. observed that menarche before age 11 heightened anxiety risks, particularly under social pressures like peer judgment [7], a pattern mirrored in our cohort where physical changes likely outstripped emotional preparedness. Copeland et al. reported similar findings, noting that early puberty disrupts emotional regulation, increasing internalizing symptoms [9]. Our 25.5% severe anxiety rate at 8–9 years parallels their data, suggesting a conserved mechanism across populations where premature physical maturity fosters psychological strain [9]. Likewise, Kaltiala-Heino et al. found early puberty associated with anxiety and social maladjustment, particularly in school settings [3], a dynamic relevant to Chennai's competitive academic environment.

Menstrual irregularity's link to anxiety corroborates Graber et al.'s work, which attributes heightened stress to hormonal instability [11]. Their findings on estrogen's role in amplifying amygdala responses are echoed by Goddings et al., who describe puberty's impact on emotional control [5]. Our 20.4% severe anxiety prevalence among girls with irregular cycles aligns closely with Rachmawati et al.'s study, where 31.9% of Indonesian adolescents with early menarche reported significant anxiety [2]. This similarity across Asian contexts underscores how physiological unpredictability exacerbates distress, particularly in cultures with menstrual taboos [2,19]. Bisaga et al. further support this, noting that irregular cycles correlate with mood disturbances in adolescents [13], reinforcing our observation of a strong statistical association ($p < 0.01$).

Socially, our results resonate with Stice et al.'s findings that early-maturing girls face body image concerns and peer scrutiny, increasing anxiety risks [4]. The 35.3% moderate anxiety at 8–9 years mirrors their data on self-consciousness among girls perceived as outliers [4]. Mendle et al. similarly link early menarche to social isolation and internalizing problems [10], a pattern likely intensified in India by cultural silence around menstruation [19]. Sequeira et al. found that early pubertal timing heightens peer-related stress, particularly in girls [14], aligning with our cohort's vulnerability to social pressures. In contrast, Western studies like Angold et al. suggest stronger parental support may mitigate such effects [21], highlighting a potential area for intervention in India, where family dynamics vary [24].

The 17.6% of girls reporting no anxiety is a significant finding, suggesting resilience factors. Sawyer et al. propose that supportive environments, including family and school resources, buffer puberty's psychological impact [12], a hypothesis supported by our data from urban Chennai, where healthcare access may play a role [25]. This contrasts with Smith et al.'s focus on negative cognitive styles in early maturers [6], indicating that protective factors like parental education or peer support, as noted by Negriff et al. [17], may explain our no-anxiety subgroup. Compared to Deardorff et al.'s findings of universal distress in early puberty [18], our results suggest context-specific moderators, warranting further study.

Our 55.8% anxiety prevalence is lower than some Western estimates, such as Ge et al.'s 70% for early-maturing girls [20], possibly due to cultural differences in symptom reporting or our focus on anxiety alone. However, it aligns with Zhou et al.'s Asian data, where 50–60% of early-maturing adolescents showed psychological symptoms [22]. The GAD-7's robustness in detecting anxiety, as validated by Spitzer et al. [8], strengthens our findings, though self-report biases, as noted by Mossman et al. [23], may affect accuracy, particularly given menstruation's sensitivity in India [19]. Our cross-sectional design, a limitation shared with Joinson et al. [15], precludes causality, suggesting a need for longitudinal research like that of Lien et al. [16].

These findings advocate for routine GAD-7 screening in schools to identify at-risk girls, aligning with Plummer et al.'s recommendations for adolescent mental health monitoring [24]. Integrating menstrual health education, as suggested by Chandra-Mouli et al. [25], could reduce stigma and anxiety, particularly for those with irregular cycles. Training educators to recognize distress, per Rudolph et al.'s model [26], would enhance early intervention. The heightened risk at 8–9 years supports targeted support for younger adolescents, as emphasized by Ellis et al. [27].

In conclusion, this study confirms that early menarche, particularly at 8–9 years, and menstrual irregularity significantly increase anxiety risks in Indian adolescent girls, with 55.8% affected. Comparisons with global and regional studies [2–27] reveal shared biological and social drivers, while the 17.6% with no anxiety highlights resilience factors. By addressing a critical data gap, these results underscore the need for integrated mental health and menstrual education programs to foster adolescent well-being

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