# Relation of Timing of Menarche in Depression, Anxiety and Stress among Adolescence Girls of West Bengal, India

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## ABSTRACT

**Background**: Existing literature presents controversial relationship between the timing of menarche and psychological distress. This study was undertaken to find out the relationship between age at menarche and mental health viz. depression, anxiety and stress among adolescent girls.

**Methods:** This is a cross-sectional questionnaire-based study conducted among adolescent female having age limit 10-16 years. Only unmarried adolescent females were included in the study however, females with gynecological, psychological or other medical problems were excluded from the study. Valid and reliable questionnaire such as age at menarche and DASS-21 were used for assessment of depression, anxiety, stress. Then, the logistic regression analysis was used to explore the relationship between psychological distress and age at menarche. t-test was used to compare psychological distress between normative and early / late age at menarche. $P<0.05$ was considered as significant.

**Results:** The findings from bivariate regression analysis show that early menarche is associated with significantly higher odds of depression, anxiety and stress compared to normal age at menarche (Depression: OR = 4.160; 95% CI = 2.458 to 7.042; p <0.0001. Anxiety: OR = 2.537; 95% CI = 1.761 to 3.638; p <0.0001. Stress: OR = 4.824; 95% CI = 3.485 to 6.678; p <0.0001). Like odd ratio, adjusted odd ratio from multiple regression analysis of depression, anxiety and stress also significantly higher among adolescent girls having early age at menarche in compare with normal menarcheal age group adolescents (Depression: AOR = 3.208; 95% CI = 0.660 to 1.671; p = 0.0000. Anxiety: AOR = 1.418; 95% CI = 0.048 to 0.651; p = 0.0231. Stress: AOR = 1.451; 95% CI = 0.093 to 0.651); p = 0.0088). There is no significant difference of mental stress indices between late age at menarche in respect to normal age at menarche (Depression: OR = 1.178; 95% CI = 2.458 to 7.042; p = 0.7344. Anxiety: OR = 1.032; 95% CI = 0.471 to 2.260; p = 0.9370. Stress: OR = 1.172; 95% CI = 0.610 to 2.258; p = 0.6338).

**Conclusion:** The present findings indicate that early age at menarche is associated with elevated odds of depression, anxiety and stress in compared to females with normative as well as late age at menarche among adolescent school girls.

**Key words:** Age at menarche, depression, anxiety, stress,

## INTRODUCTION

The timing of menarche is an indicator development of puberty among female. The hormonal changes during puberty increases emotional sensitivity leading to development of depressive symptoms (1-3). The physical changes during puberty affect mental well-being (4). Previous studies indicated that age at menarche was associated with risk of psychiatric disorders (5). Evidences suggest that early menarche have been associated with increased risk of depression and anxiety due to the social and biological stresses associated with off-timed pubertal development (6,7). Existing literature survey presents conflicting findings regarding the relationship between age at menarche and mental health. Some studies suggested that early menarche increases the risk of

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depression (8). While several other studies find no significant association between age at menarche and depression (9). Thus, present study was undertaken to find out the association between age at menarche with mental well-being in term of depression, anxiety and stress. The aim of this study was to confirm the association between psychological and gynecological health. This study explores the relation of timing of menarche and psychological distress among Bengali adolescent females.

# METHODOLOGY

**Subject:** A cross-sectional study was done in Hooghly district and adjoining areas. The population was unmarried Bengali female adolescent students who were randomly selected from schools having standard class V to class XII in the age group between 10 to 16 years. 1728 adolescence girls were participated initially in this study. Among total sampled 1634 attained menarche and were eligible for analysis. On the basis of age of menarche, subjects are divided into three group: early menarcheal group, attained menarche at 11 years or younger (10); normal menarcheal group attained menarche between 12 years to 14 years and late menarcheal group attained menarche >14 years (11).

Inclusion criteria:

- Willing to participate in the study and signed the written informed consent
- Belonging to age limit 10 to 16 years
- Started menstruating at the time of data collection
- Completed the questionnaire

Exclusion criteria:

- Not willing to participate
- Had not attained menarche
- Did not complete the questionnaire
- Age below 10 year or above 16 years

**Questionnaire:**

A self-administered questionnaire having questions related to their age, menarche age, different life style factors & menstrual factors such as menarche age, duration of menses, regularity, pain etc. were applied. The questionnaires were translated to the local language (Bengali) as well.

**Anthropometric measurements:**

Body weight was measured in light clothing and bare feet using bathroom scale accurate to 0.5kg. The scale was kept on a flat surface and adjusted with '0' mark. Now the subject was requested to step on it in bare feet. Weight was recorded to the nearest 0.5kg. Height was measured using anthropometric rod without footwear on to the nearest 0.1 cm. BMI was calculated from the height and weight using following equation: BMI ($kg/m^2$) = weight (kg) / $height^2$ (m).

**DASS – 21 (Depression Anxiety Stress Scale) measurement:**

Depression, Anxiety and stress ware calculated by using DASS 21 (12). The DASS is a self-report instrument, and no special skills are required to administer it. There are 21 items that need to be scored and the assessor advises the subjects to consider what they have experienced in the past week as well as at the present and to

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choose the answer that first comes in mind. Depression symptoms related items are question number 3, 5, 10, 13, 16, 17, 21. Depression levels were selected from summation of total scores.

Similarly, Anxiety disorder related items are question number 2, 4, 7, 9, 15, 19, 20. Degree of anxiety was selected from summation of total scores.

Stress disorder related items are question number 1, 6, 8, 11, 12, 14, 18. Degree of stress was selected from summation of total scores.

Table-1: Severity of psychological stress on the basis of DASS-21

| Score of Psychological factors | | | Severity/Degree |
|---|---|---|---|
| Depression | Anxiety | Stress | |
| 0-4 | 0-3 | 0-7 | Normal |
| 5-6 | 4-5 | 8-9 | Mild |
| 7-10 | 6-7 | 10-12 | Moderate |
| 11-13 | 8-9 | 13-16 | Severe |
| ≥14 | ≥10 | ≥17 | Extreme severe |

**Statistical analysis:** Quantitative data was presented as percentage and/or mean ± standard deviation. The descriptive data analysis was used to explore the risk of timing of menarche with mental health indices. t-test was used to compare psychological distress between normative and early / late age at menarche. $P<0.05$ was considered as significant. Also, the predictive psychological impact of early menarche was evaluated using bivariate and multivariate logistic regression analysis.

## RESULTS

BMI and psychological health indices of normal, early and late menarcheal group of adolescent girls presents in table-1. There were significant difference of BMI and psychological indices between normal and early menarcheal group and insignificant difference between normal and late menarcheal group. Mean menarcheal age differed significantly either in between normal and early and in between normal and late menarcheal group of girls.

Table-2: Comparison of psychological health indices between normal, early and late menarcheal group of adolescent girls

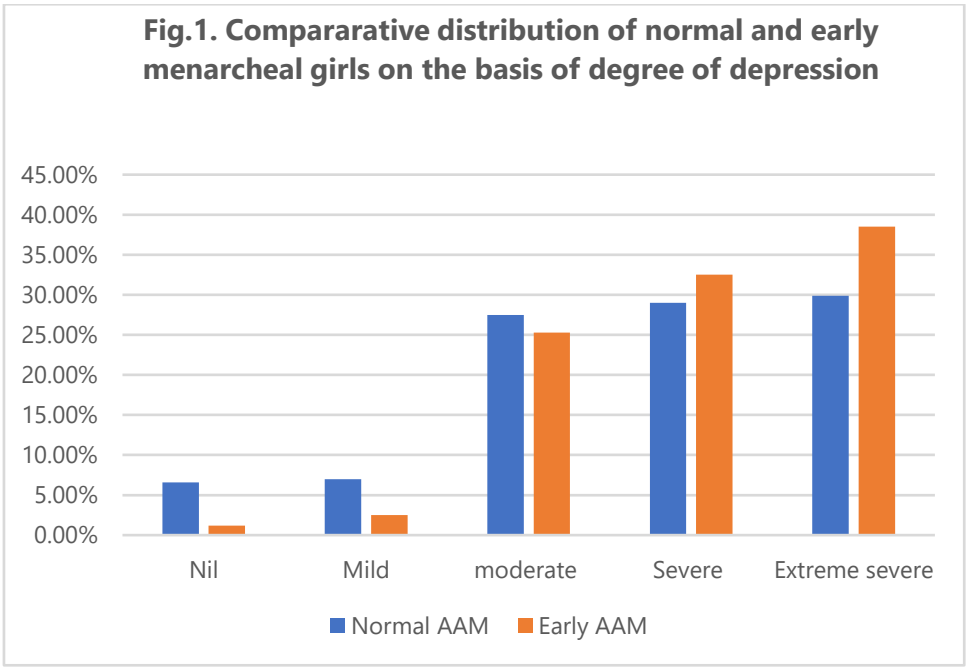
| **Parameters** | **Menarcheal age group** | | |
|---|---|---|---|
| | **Normal (n=1170)** | **Early (n=434)** | **Late (n=42)** |
| **Age (year)** | 15.25 ± 1.29 | 15.55 ± 1.14 ($p<0.001$) | 15.80 ± 1.05 ($p<0.05$) |
| **BMI (kg/m$^2$)** | 20.71 ± 4.27 | 21.99 ± 4.74 ($p<0.001$) | 19.51 ± 3.2 ($p<0.05$) |
| **Age at menarche** | 12.83 ± 0.73 | 10.54 ± 0.64 ($p<0.001$) | 15.05 ± 0.22 ($p<0.001$) |
| **Depression Score** | 10.72 ± 3.90 | 11.68 ± 3.87 ($p<0.001$) | 11.02 ± 4.42 ($p>0.05$) |
| **Anxiety score** | 8.83 ± 4.15 | 10.31 ± 4.40 ($p<0.001$) | 9.22 ± 4.23 ($p> 0.05$) |
| **Stress score** | 11.88 ± 4.33 | 13.00 ± 3.77 ($p<0.001$) | 11.88 ± 4.24 ($p>0.05$) |

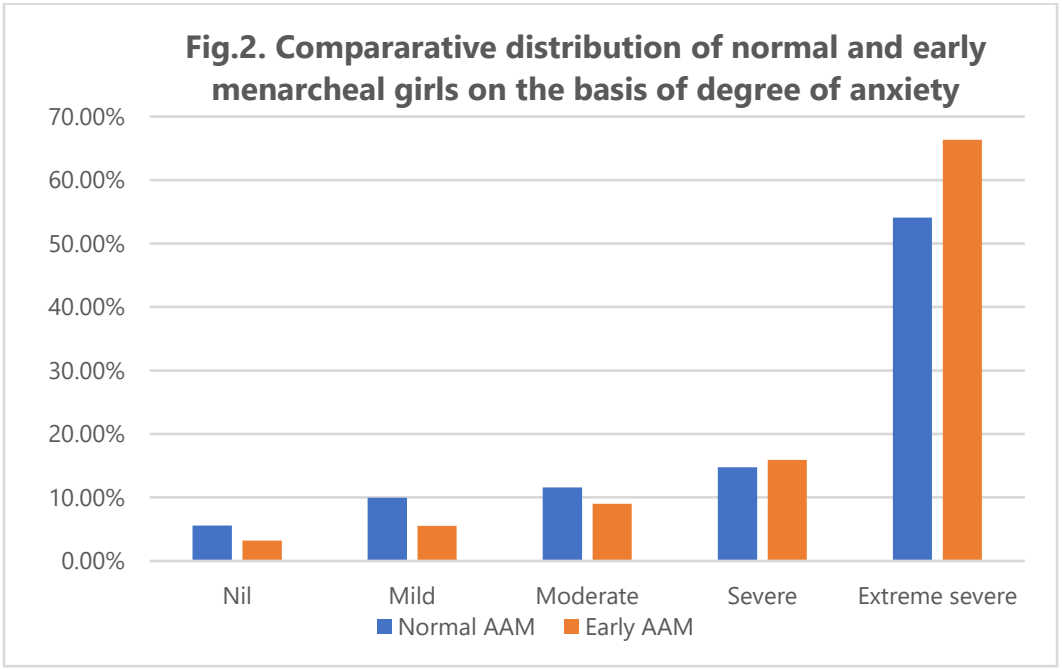
- Data represents mean ± standard deviation

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**Normal versus early age at menarche**

Result of our study indicated that severity of psychological distress viz depression, anxiety and stress were more in females those attained menarche at an early age compared to those with normal age at menarche. More percentage of females with early age at menarche suffered in severe psychological distress in compare with females with normative age at menarche (fig.1 to 3). Odds of depression were significantly higher among females with early age at menarche compared to those with normal age at menarche (table-2). Like depression both anxiety and stress odds were significantly higher in group of females with early age at menarche in respect to females with normal age at menarche (table-3). Significantly higher adjusted odd ratio (accounting for confounding variables namely age and body mass index) for psychological indices also indicated that early menarche was associated with psychological distress (table-4).



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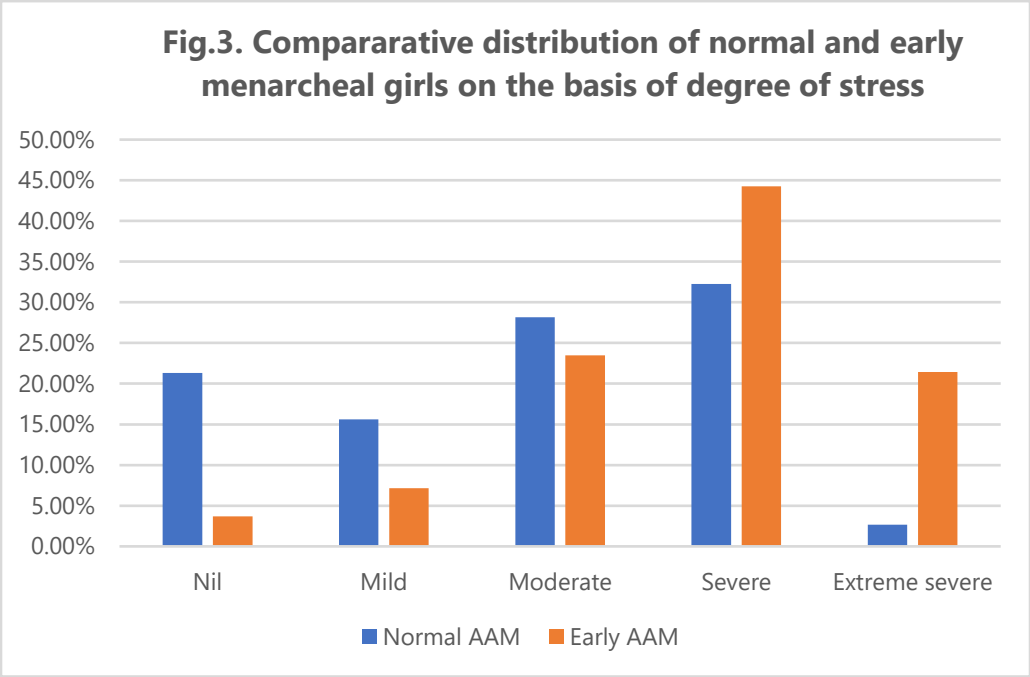



Table-3: Bivariate logistic regression analysis for psychological health of normal and early age at menarche

| **Psychological indices** | | **OR** | **95% CI** | **P** |
|---|---|---|---|---|
| **Depression** | Nil to mild | 1(Reference) | ---------- | ---------- |
| | Moderate to severe | 4.160 | 2.458 to 7.042 | < 0.0001 |
| **Anxiety** | Nil to mild | 1(Reference) | ---------- | ---------- |
| | Moderate to severe | 2.531 | 1.761 to 3.638 | < 0.0001 |
| **Stress** | Nil to mild | 1(Reference) | ---------- | ---------- |
| | Moderate to severe | 4.824 | 3.485 to 6.678 | < 0.0001 |

Table-4: Analysis of psychological indices associated with early menarche by multivariate logistic regression

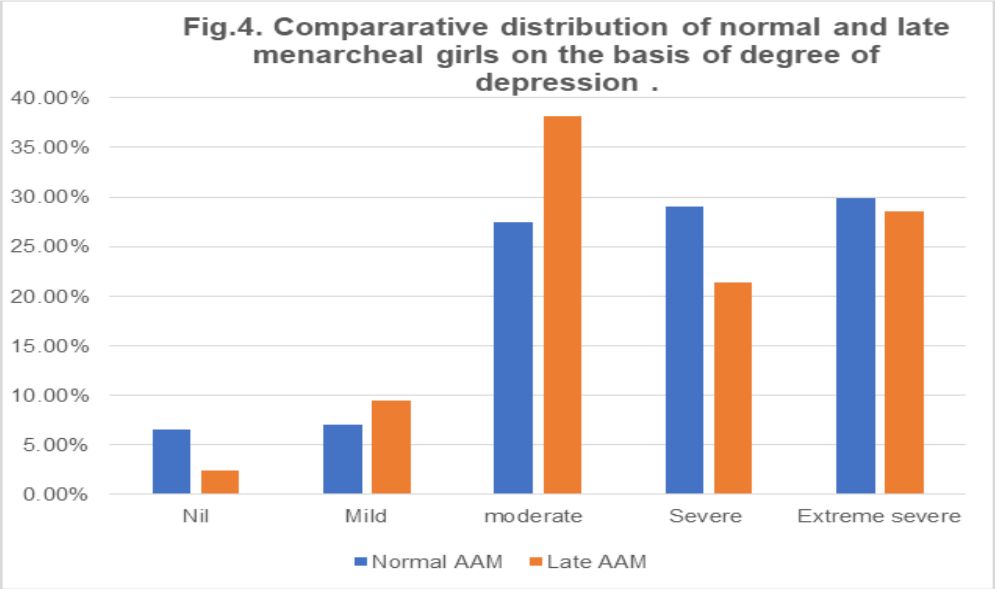
| **Psychological indices** | **Coefficient** | **Adjusted Odd Ratio *** | **95% CI** | **P** |
|---|---|---|---|---|
| **Depression** | 1.166 | 3.208 | 0.660 to 1.671 | 0.0000 |
| **Anxiety** | 0.349 | 1.418 | 0.048 to 0.651 | 0.0231 |
| **Stress** | 0.372 | 1.451 | 0.093 to 0.651 | 0.0088 |

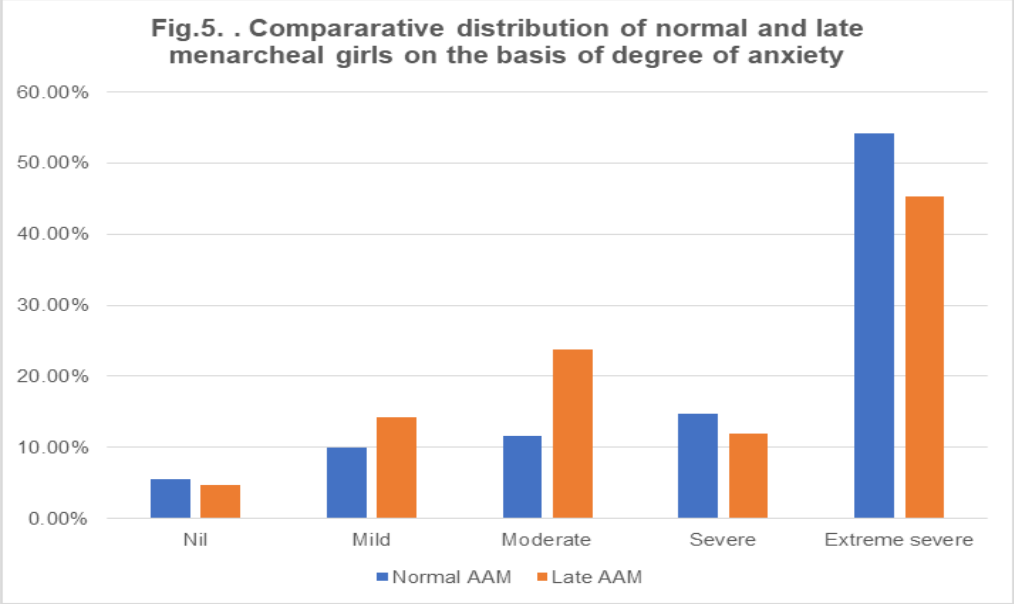
- Considering age and BMI as confounder

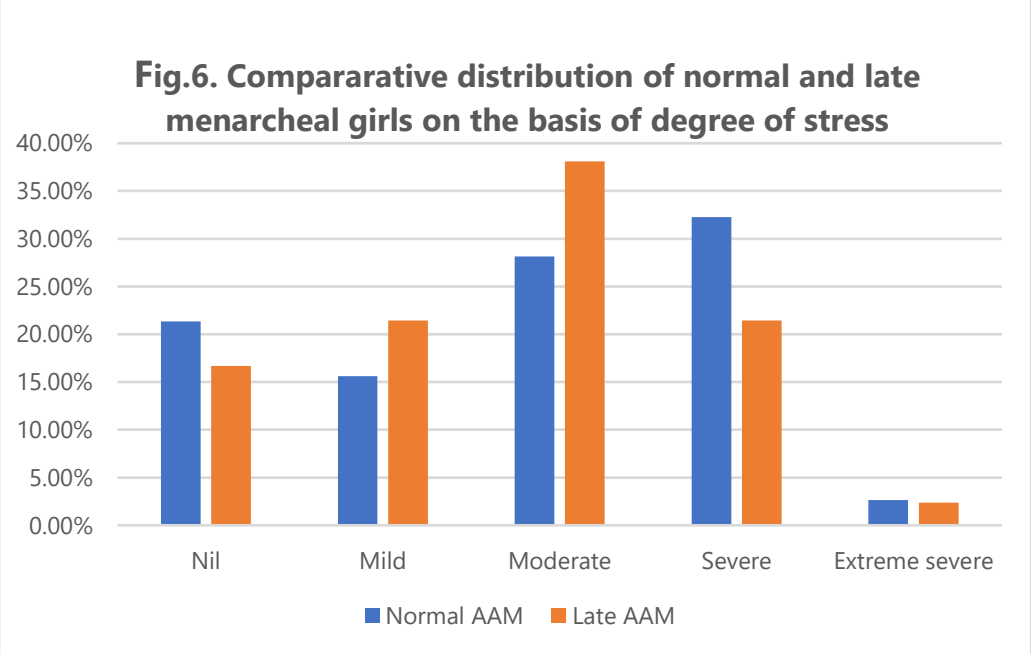
**Normal versus late age at menarche**

More percentage of females with late age at menarche suffer in mild to moderate psychological distress in compare with females with normative age at menarche (fig.4 to 6). Severity of psychological distress among females with late age at menarche comparatively lower than female's adolescent having normative age at menarche. Odd ratio as well as adjusted odd ratio of psychological depress indices viz depression, anxiety and stress were insignificantly differ among females with late age at menarche compared to those with normal age at menarche (table-4 and 5).

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Table-5: Bivariate logistic regression analysis for psychological health of normal and late age at menarche

| **Psychological indices** | | **OR** | **95% CI** | **P** |
|---|---|---|---|---|
| **Depression** | Nil to mild | 1(Reference) | ---------- | ---------- |
| | Moderate to severe | 1.178 | 0.456 to 3.043 | 0.7344 |
| **Anxiety** | Nil to mild | 1(Reference) | ---------- | ---------- |
| | Moderate to severe | 1.032 | 0.471 to 2.260 | 0.9370 |
| **Stress** | Nil to mild | 1(Reference) | ---------- | ---------- |
| | Moderate to severe | 1.172 | 0.610 to 2.258 | 0.6338 |

Table-6: Analysis of psychological indices associated with late menarche by multivariate logistic regression

| **Psychological indices** | **Coefficient** | **Adjusted Odd Ratio** | **95% CI** | **P** |
|---|---|---|---|---|
| **Depression** | - 0.140 | 0.869 | - 1.202 to 0.922 | 0.7959 |
| **Anxiety** | - 0.176 | 0.838 | - 0.971to 0.619 | 0.2813 |
| **Stress** | - 0.414 | 0.661 | - 0.109 to 0.281 | 0.2427 |

- Considering age and BMI as confounder

## DISCUSSION

The aim of this study was to evaluate the association between timing of menarche and psychological distress. The results of our study demonstrated that females with early age at menarche mostly suffer in severe to extreme severe type of distress in respect to either normative age at menarche. Odds of psychological distress significantly higher in female adolescent having early age at menarche in compare to normative age at menarche. Late age at menarche has shown to decrease odds for psychological distress compared to normative age at menarche, but this change was not statistically significant. Previous studies reported that earlier age at menarche was associated with elevated depressive symptoms in early adolescence (13, 14). The current findings support to the early timing hypothesis, which predicts that girls who mature earlier than their peers, are more vulnerable to psychological distress (15, 16). Earlier studies suggested that body image and self-esteem issue for rapid physical development of early menarcheal girls increase the risk of depression (17). Besides this early menarche could lead to self-harming behaviors and early pregnancies which are considered as risk factors depression (18). Feeling of social isolation of early menarcheal girls for physical difference from their peers increases anxiety (19).

Several factors may explain these findings. Early menarche results in earlier exposure to estrogen and other sex hormones, which are known to play a role in mood regulation (20, 21). Premature onset of hormonal changes may enhance the risk of depression (22). Estrogen interacts with various neurotransmitter system including serotonergic, dopaminergic and cholinergic which are crucial for mood regulation, nervous irritability and cognitive functions (23). Estrogen-induced disruption of neurotransmitter system may contribute to cognitive biases leads to depression (24). The hippocampus and amygdala, key regions of emotional regulation are rich in estrogen receptor. Early menarche may alter the development of these regions and increasing susceptibility to depression (25).

Early menarche is associated with heightened hypothalamo-pituitary-adrenal axis reactivity. Estrogen potentiates stress-induced cortisol release and premature activation of this axis may lead to maladaptive stress responses.

Early puberty coincides with increased cortisol secretion in response to psychosocial stressors leading to higher depression (26, 27).

Thus, beyond estrogen, the interplay of cortisol, progesterone and other hormones during puberty may amplify risk of depression (28). Progesterone which fluctuates cyclically with estrogen, modulates mood through its metabolites such as allopregnanolone. Early menarche may disrupt the typical estrogen-progesterone ratio leading to exaggerated mood swings (29).

## CONCLUSION

The results of this study indicate that early menarche is associated with elevated odds of depression, anxiety and stress compared to normative and late age at menarche. Thus, these results highlight the association between timing of menarche and mental health outcomes. However, it is still uncertain whether early age at menarche leads to depression or vice versa or consequences of one another.

### Consent

The study was non-invasive. The prior written permission of the Institutional authority was taken. The written informed consent was obtained from the study participants. Participants were informed that the data obtained from them would be kept confidential.

### Ethical Approval

Written ethical approval has been collected and preserved by the author(s).

### Competing Interests

Authors have declared that no competing interests exist

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