



## Assessment of the relationship between body mass index (BMI) and menstrual problems among adolescent girls: A descriptive correlational study in schools of Tamil Nadu and Odisha

Seema Swain<sup>1</sup>, Subhashree Nayak<sup>2</sup>, Subhrasmita Samal<sup>1</sup>, Sephali Moharana<sup>3\*</sup>

<sup>1</sup> Assistant Professor, Department of Obstetrics & Gynaecology Nursing, VISWASS College of Nursing, Bhubaneswar, Odisha, India

<sup>2</sup> Nursing Officer, Department of Obstetrics and Gynaecology Nursing, Bhadrak, Odisha, India

<sup>3</sup> Assistant Professor, Department of mental health nursing, SUM Nursing College, Siksha 'O' Anushandhan University, Bhubaneswar, Odisha, India

**Corresponding Author:** Sephali Moharana

### Abstract

**Background:** Adolescence is a critical stage of growth and development characterized by significant physical, psychological, and hormonal changes. Menstruation is an important physiological process in adolescent girls, but menstrual problems such as dysmenorrhoea, amenorrhoea, oligomenorrhoea, polymenorrhoea, and menorrhagia are common during this period. Body Mass Index (BMI) plays an important role in regulating hormonal balance and may influence menstrual health.

**Methods:** The present study aimed to assess the relationship between menstrual problems and Body Mass Index (BMI) among adolescent girls in selected schools of Tamil Nadu and Odisha. A quantitative research approach with a descriptive correlational design was adopted for the study. The study was conducted among adolescent girls aged 13–18 years studying in selected schools. A sample of 100 adolescent girls was selected using non-probability purposive sampling technique. Data were collected using a structured demographic questionnaire, menstrual history questionnaire, menstrual problem rating scale, and anthropometric measurements for BMI calculation. Content validity of the tool was established by experts in nursing, gynecology, and public health. The reliability of the tool was tested using appropriate statistical methods.

**Results:** The collected data were analyzed using descriptive and inferential statistics, including mean, standard deviation, percentage, correlation coefficient, and chi-square test. The findings of the study revealed that menstrual problems were common among adolescent girls and there was a significant relationship between BMI and menstrual problems. Underweight and overweight adolescents showed a higher prevalence of menstrual irregularities.

**Conclusion:** The study concluded that BMI plays an important role in menstrual health among adolescent girls. Early identification and health education regarding nutrition, weight management, and menstrual hygiene are essential to improve reproductive health among adolescents.

**Keywords:** Adolescent girls, menstrual problems, body mass index (BMI), dysmenorrhoea, menstrual irregularities, correlation study

### Introduction

Maturity in girls is commonly indicated by the onset of the first menstrual period, known as menarche. Menstruation refers to the regular discharge of blood from the uterus, which occurs due to the shedding of the endometrial lining when the levels of estrogen and progesterone decrease following the regression of the corpus luteum. The length of the menstrual cycle, as well as the duration and amount of menstrual bleeding, can vary widely among healthy women. Menstrual disorders are categorized based on factors such as the age at onset, frequency of the cycle, duration, volume of bleeding, and the characteristics of the bleeding. These disorders are more frequently observed among adolescents than in older women because the physiological functions of the hypothalamus, ovaries, and uterus are still developing. Additionally, several other factors may also contribute to the occurrence of menstrual disorders <sup>[1]</sup>.

The menstrual cycle is an important indicator of women's health. Menstrual disorders are one of the major gynecological problems among women, particularly adolescents, and often create anxiety for both the girls and their families. Several factors, including body mass index (BMI), physical activity, and stress, may influence the occurrence of menstrual disorders. Therefore, this study was

conducted to examine the relationship between menstrual disorders and anthropometric indices among female high school students <sup>[2]</sup>.

In India, adolescent girls make up a significant portion of the population and represent an important part of society, as they are future mothers and homemakers. During adolescence, girls require adequate amounts of nutrients not only to support rapid physical growth but also to build sufficient nutritional reserves for future needs such as pregnancy and lactation. Menstruation is a vital component of the female reproductive cycle; however, menstrual irregularities among adolescent girls can disrupt their daily activities and affect their overall well-being during adolescence and early adulthood. Poor hemoglobin levels and nutritional status, often assessed through Body Mass Index (BMI), are commonly associated with menstrual irregularities among females across different age groups. <sup>(3)</sup> Adolescence is a stage of development marked by maturation and significant physical, emotional, social, and psychological changes. It is generally defined as the age period between 13 and 19 years. Anemia is one of the most common nutritional deficiencies among adolescents, particularly in Pakistan, where more than 40% of the female

population is affected. Among them, about 35% are girls aged between 15 and 19 years [4].

Menstrual irregularities are a common problem among adolescent girls, particularly in their teenage years and early twenties. Factors such as overweight, lifestyle patterns, eating habits, and body mass index (BMI) contribute to these problems. The present study was conducted among 75 B.Sc. Nursing students (1st to 4th year) at SMVNC, Puducherry, using a quantitative descriptive research design with quota sampling. Menstrual irregularities were assessed and BMI was calculated. The findings revealed a relationship between BMI and menstrual irregularities among adolescent girls [5].

Many adolescent girls experience menstrual abnormalities such as dysmenorrhea, lower abdominal and back pain, and abnormal weight gain. Dysmenorrhea, or painful menstruation, usually begins at or just before the onset of menstruation and subsides by the end of the menstrual period. Body Mass Index (BMI) is an indicator of an individual's health status, and a BMI above 30 kg/m<sup>2</sup> is considered obese. Changes in lifestyle and dietary habits can affect the health status of adolescent girls, leading to hormonal imbalances that may result in menstrual irregularities [6].

A descriptive study was conducted among 380 unmarried girls aged 15–18 years from five secondary schools in Damietta City, Egypt. Data were collected using a structured questionnaire, a physical assessment sheet for anthropometric measurements, and a 19-item menstrual cycle questionnaire. The results showed a significant relationship between BMI and menstrual cycle regularity, with higher rates of irregular menstruation among obese (65.9%) and overweight (51.4%) students compared to those with normal weight (41.7%). The study concluded that overweight and obese girls are more likely to experience menstrual irregularities and recommended health education programs to prevent obesity and its complications [7]. A cross-sectional study was conducted among 2000 girls aged 9–18 years in Shiraz to examine the relationship between body mass index (BMI), menstrual disorders, and sex hormones. Data were collected using questionnaires and analyzed with the Chi-square test. The results showed a significant association between BMI and menstrual cycle length, spotting, passing clots, and menstrual bleeding, but no significant relationship with sex hormones [8].

Obesity is a major health problem worldwide and has become an emerging epidemic. It is associated with several health complications such as cardiovascular diseases, diabetes, asthma, arthritis, chronic pain, and Alzheimer's disease. Studies reported that the prevalence of obesity was over 35% in the United States during 2009–2010. It indicated that the prevalence of obesity was about 22%. Childhood obesity is increasing in both developed and developing countries and can influence various aspects of pubertal development, including the onset of puberty and hormonal changes [9].

This study examined the association between Body Mass Index (BMI) and primary dysmenorrhea among 127 female students at SMAN 07 Pekanbaru using a cross-sectional design. Data were collected through a questionnaire and BMI classification. The results showed that 79.5% of students experienced primary dysmenorrhea, but there was no significant association between BMI and dysmenorrhea ( $p = 0.844$ ). The findings suggest that dysmenorrhea may be

influenced by multiple factors such as genetics, hormones, lifestyle, and psychological conditions [10].

## Methodology

### Study Approach

The study adopted a quantitative research approach to assess the relationship between menstrual problems and Body Mass Index among adolescent girls.

### Study Design

A descriptive correlational research design was used to determine the relationship between menstrual problems and BMI among adolescent girls.

### Study Setting

The study was conducted in selected schools of Tamil Nadu and Odisha among adolescent girls studying in secondary and higher secondary classes.

### Study duration

The duration of the study was 6 weeks, including the period for data collection, analysis, and interpretation.

### Sampling Method

A non-probability purposive sampling technique was used to select the adolescent girls who met the inclusion criteria.

### Sample size

The sample size for this descriptive study was estimated using the single-proportion formula:

Sample size =  $4pq/d^2$   $p$  = Prevalence rate (84%)

$n = 4 \times p \times (100-p)/d^2$  Allowable errors (16%)

$= 4 \times 84 \times 16/5 \times 5 \times q = 100 - p$

$= 5376/25 = 215$

215+10 (To adjust for incomplete data) 225 samples were included in this study. TamilNadu 225 samples and Odisha 225 samples so total 450 samples were selected for this study.

### Inclusion Criteria

- Are aged 13–18 years
- Have attained menarche
- Are studying in selected schools
- Are willing to participate in the study
- Are present during the data collection period

### Exclusion Criteria

- Have chronic illness or hormonal disorders
- Are absent during data collection
- Are not willing to participate

### Details of the research tool

Research data were collected using four tools:

**Tool 1:** This section was used to collect the baseline characteristics of the participants. It consisted of 8–10 items. The variables included: Age, Class/educational level, Religion, Type of family (nuclear/joint), Residence (rural/urban), Mother's education, Father's education, Dietary pattern (vegetarian/non-vegetarian), socioeconomic status, Source of information regarding menstrual health. The responses were recorded in multiple-choice format.

**Tool 2: Menstrual History Questionnaire.** This section assessed the menstrual characteristics of adolescent girls. It contained 8–10 questions. Items included: Age at menarche, Length of menstrual cycle, Duration of menstrual flow, Regularity of menstruation, Amount of menstrual bleeding, Presence of menstrual pain, Use of sanitary products, Absenteeism from school during menstruation. Responses were recorded using multiple-choice and yes/no format.

**Tool 3: Menstrual Problem Rating Scale.** This section was used to assess the presence and severity of menstrual problems among adolescent girls. The scale included common menstrual problems such as: Dysmenorrhoea (painful menstruation), Amenorrhoea (absence of menstruation), Oligomenorrhoea (infrequent menstruation), Polymenorrhoea (frequent menstruation), Menorrhagia (heavy menstrual bleeding), premenstrual symptoms (irritability, headache, fatigue). Each item was rated on a three-point Likert scale: 0 – Not present, 1 – Mild, 2 – Moderate, 3 – Severe. Higher scores indicated greater severity of menstrual problems.

**Tool 4: Anthropometric Measurement for BMI.** This section assessed the Body Mass Index (BMI) of adolescent girls using standard anthropometric measurements.

**Height Measurement:** Height was measured using a stadiometer with participants standing barefoot in an upright position.

**Weight Measurement:** Weight was measured using a calibrated weighing scale with participants wearing light clothing and no footwear.

**BMI Calculation:** BMI was calculated using the formula:

$$BMI = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}$$

**BMI Classification (WHO):**

BMC Category	Value
Underweight	< 18.5
Normal weight	18.5 – 24.9
Overweight	25 – 29.9
Obese	≥ 30

### Scoring interpretation (menstrual problems)

#### Score Range Interpretation

0–10 Mild menstrual problems

11–20 Moderate menstrual problems

21–30 Severe menstrual problems

#### Tool Standardization

The tool was validated by experts in nursing, gynecology, community health nursing, and research methodology. Necessary modifications were made according to expert suggestions to ensure content validity.

Reliability analysis showed strong internal consistency, with Cronbach’s  $\alpha$  values of .91. Pre-testing (tryout) done in hospital for clarity, ambiguity, and timing.

#### Study variables

**Demographic variables:** Age, class, dietary pattern, family type, parental education, etc.

**Independent variables:** Body Mass Index (BMI)

**Dependent Variable:** Menstrual problems

#### Data collection procedure

Data collection is the systematic process of gathering information relevant to the research objectives. The data for

the present study were collected after obtaining formal permission from the concerned school authorities in the selected schools of Tamil Nadu and Odisha.

Before initiating the data collection process, the researcher obtained ethical clearance from the Institutional Ethics Committee. Permission was also obtained from the school principals and administrative authorities of the selected schools. The purpose and objectives of the study were clearly explained to the participants.

The participants who met the inclusion criteria were selected using a non-probability purposive sampling technique. The researcher established rapport with the adolescent girls and explained the nature and purpose of the study. Informed consent was obtained from the participants, and confidentiality of the information was assured.

The data were collected using a structured questionnaire and anthropometric measurements. The data collection tool consisted of four sections:

1. **Section A:** Demographic variables
2. **Section B:** Menstrual history questionnaire
3. **Section C:** Menstrual problem rating scale
4. **Section D:** Anthropometric measurements for Body Mass Index (BMI)

Initially, the participants were asked to complete the demographic information and menstrual history questionnaire. The researcher provided necessary instructions and clarified any doubts during the process.

After completing the questionnaire, the height and weight of each participant were measured using standard equipment. Height was measured using a stadiometer with the participant standing upright without footwear. Weight was measured using a calibrated weighing scale with the participant wearing light clothing and no shoes.

The Body Mass Index (BMI) was calculated using the standard formula:

$$BMI = \text{Weight (kg)} / \text{Height (m)}^2$$

Based on the calculated BMI values, the participants were classified into underweight, normal weight, overweight, and obese categories according to standard BMI classification guidelines.

The data collection process was carried out over a period of four to six weeks. Approximately 10–15 participants were assessed per day to ensure accuracy and proper measurement.

At the end of the data collection session, the researcher thanked the participants for their cooperation and provided brief health education regarding menstrual hygiene, nutrition, and healthy lifestyle practices.

#### Ethical considerations

Ethical approval was obtained from the Institutional Ethics Committee. Permission was obtained from school authorities. Informed consent was obtained from participants. Confidentiality and anonymity were maintained. Participants were informed that they could withdraw from the study at any time.

#### Statistical Analysis

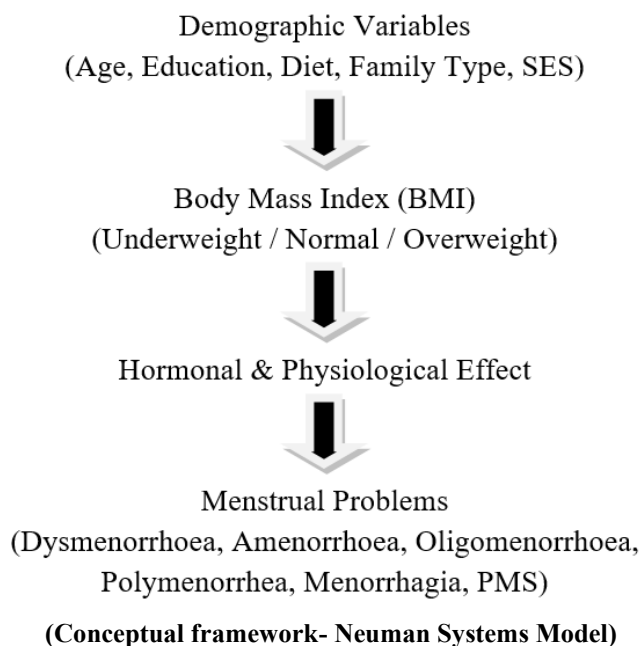
Statistical analysis was performed using SPSS version 21. Demographic data were analyzed using frequencies and percentages, while baseline characteristics were summarized using means and standard deviations. Appropriate description and inferential statistics were applied, and frequency tables were constructed for significant data.

Pearson correlation coefficient to determine the relationship between BMI and menstrual problems. Chi-square test to find association with demographic variables. Significance level:  $p < 0.05$ .

### Theoretical framework

The study is based on the Neuman Systems Model, which explains that individuals respond to various internal and external stressors that affect their health and well-being. According to this model, the human body functions as an open system interacting continuously with environmental

factors. In this study, Body Mass Index (BMI) acts as a physiological factor that may influence the menstrual health status of adolescent girls. Any imbalance in body weight, such as underweight or overweight, may act as a stressor affecting hormonal balance and leading to menstrual problems. The Neuman Systems Model emphasizes the importance of maintaining system stability through prevention and health promotion strategies. In the context of this study, maintaining a healthy BMI through proper nutrition and lifestyle can help prevent menstrual disorders and promote reproductive health among adolescents.



### Results

**Table 1:** Frequency and Percentage Distribution of Demographic Variables of adolescent girls at selected schools of Tamil Nadu and Odisha. (N= 450)

Demographic Variables	Tamil Nadu N=225		Odisha N=225	
	f	%	F	%
Age( in years)				
13 - 15 years	112	49.78	112	49.78
16 - 18 years	113	50.22	113	50.22
Educational status				
9th standard	112	49.78	112	49.78
11th standard	113	50.22	113	50.22
Number of meals per day				
2 times	36	16.00	54	24.00
3 times	152	67.56	108	48.00
4 times	37	16.44	63	28.00
>4 times	0	0.00	0	0.00
Do you have the habit of eating junk food?				
Yes	168	74.67	167	74.22
No	57	25.33	58	25.78
Do you exercise regularly?				
Yes	44	19.56	11	4.89
No	181	80.44	214	95.11
Duration of menses in days				
1 - 3 days	41	18.22	15	6.67
4 - 5 days	130	57.78	118	52.44
≥5 days	54	24.00	92	40.89
Menstrual cycle (in days)				
Every month	176	78.22	195	86.67
Monthly twice	28	12.44	15	6.67
Two months once	20	8.89	15	6.67

≥2 months	1	0.44	0	0.00
Do you have premenstrual symptoms?				
Yes	122	54.22	124	55.11
No	103	45.78	101	44.89
Are you taking any complementary therapy during menstruation?				
Yes	128	56.89	27	12.00
No	97	43.11	198	88.00
What complementary therapy do you prefer?				
Yoga	94	73.44	0	0.00
Meditation	10	7.81	0	0.00
Exercise	24	18.75	27	12.00

The above table-1 revealed that Frequency (F) and percentage (%) distribution of patients according to age in years, educational status, number of meals per day, do you have the habit of eating junk food, do you exercise

regularly, duration of menses in days, menstrual cycle (in days), do you have premenstrual symptoms, are you taking any complementary therapy during menstrual, what complementary therapy do you prefer.

**Table 2:** Correlation between BMI and level of Menstrual Problems among Adolescent Girls at selected schools of Tamil Nadu and Odisha. (N =450)

	Menstrual Problems		BMI		Correlation 'r' Value
	Mean	S.D	Mean	S.D	
TamilNadu (N =225)	17.64	3.51	22.66	3.74	r = -0.013, p = 0.851, N S
Odisha (N = 225)	20.28	3.15	22.01	3.08	r = -0.012, p = 0.863, N S
Overall (N = 450)	18.96	3.58	22.33	3.43	r = -0.046, p = 0.327, N S

The data presented in table-2 revealed that the correlation analysis showed no significant relationship between menstrual problems and Body Mass Index (BMI).

In Tamil Nadu (r = -0.013, p = 0.851) and Odisha (r = -0.012, p = 0.863), as well as overall (r = -0.046, p = 0.327), the association was not statistically significant.

**Table 3:** Association between Selected Demographic Variables and level of Menstrual Problems among Adolescent Girls at Selected Schools of Tamil Nadu. (N= 225)

Sl no	Demographic data	Chi- square	Df	P value	Level of significance
1	Age in years	13.069	2	0.001*	Significant
2	Educational status	13.069	2	0.001*	Significant
3	Type of food	7.670	4	0.104	Non-significant
4	Numbers of meals per day	0.759	4	0.944	Non-significant
5	Do you have the habit of eating junk food	7.352	2	0.025*	Significant
6	Do you exercise regularly	2.835	2	0.242	Non-significant
7	Body mass index	0.107	4	0.999	Non-significant
8	Age at menarche	12.855	6	0.045	Significant
9	Duration of menses in days	7.324	4	0.120	Non-significant
10	Menstrual cycle (in days)	2.428	6	0.876	Non-significant
11	Do you have premenstrual symptoms	7.017	2	0.030	Non-significant
12	Symptoms of premenstrual syndrome	2.360	4	0.670	Non-significant
13	Are you taking any complementary therapy	6.849	2	0.033	Non-significant
14	What therapy do you prefer	2.973	4	0.562	Non-significant

The data presented in table-3 revealed that in the above table it is seen that age ( $\chi^2 = 13.069$ , p = 0.001), educational status ( $\chi^2 = 13.069$ , p = 0.001), habit of eating junk food ( $\chi^2 = 7.352$ , p = 0.025), and age at menarche ( $\chi^2 = 12.855$ , p = 0.045) had a statistically significant association with

menstrual problems. However, variables such as type of food, number of meals per day, regular exercise, body mass index, duration of menses, menstrual cycle length, premenstrual symptoms, complementary therapy, and preferred therapy showed no significant association.

**Table 4:** Association between Selected Demographic Variables and level of Menstrual Problems among Adolescent Girls at Selected Schools of Odisha. (N= 225)

Sl no	Demographic data	Chi- square	Df	P value	Level of significance
1	Age in years	25.220	2	0.001*	Significant
2	Educational status	25.220	2	0.001*	Significant
3	Type of food	1.292	2	0.524	Non-significant
4	Numbers of meals per day	2.539	4	0.638	Non-significant
5	Do you have the habit of eating junk food	1.379	2	0.502	Non-significant
6	Do you exercise regularly	4.317	2	0.116	Non-significant
7	Body mass index	4.287	4	0.369	Non-significant
8	Age at menarche	15.446	6	0.017	Significant
9	Duration of menses in days	8.694	4	0.046	Significant

10	Menstrual cycle (in days)	2.474	4	0.649	Non-significant
11	Do you have premenstrual symptoms	4.347	2	0.114	Non-significant
12	Symptoms of premenstrual syndrome	2.997	4	0.558	Non-significant
13	Are you taking any complementary therapy	5.354	2	0.069	Non-significant
14	What therapy do you prefer	2.973	4	0.562	Non-significant

Table-4 the association analysis revealed that age ( $\chi^2 = 25.220$ ,  $p = 0.001$ ), educational status ( $\chi^2 = 25.220$ ,  $p = 0.001$ ), age at menarche ( $\chi^2 = 15.446$ ,  $p = 0.017$ ), and duration of menses ( $\chi^2 = 8.694$ ,  $p = 0.046$ ) had a statistically significant association with menstrual problems. However, variables such as type of food, number of meals per day, junk food consumption, regular exercise, body mass index, menstrual cycle length, premenstrual symptoms, complementary therapy, and preferred therapy showed no significant association.

### Discussion

A cross-sectional study among 217 women examined the relationship between dietary habits, body composition, and menstrual disorders. The results showed that 52.5% of participants experienced menstrual problems such as painful menstruation, premenstrual syndrome, and irregular cycles. Higher calorie intake and obesity were significantly associated with an increased risk of menstrual disorders. <sup>(11)</sup> A cross-sectional study among 200 college girls aged 18–22 years in Madurai assessed the prevalence of menstrual abnormalities and their association with BMI and stress. The results showed that 47.5% had irregular cycles and dysmenorrhea was the most common disorder. Underweight students had more irregular cycles, and stress was significantly related to menstrual irregularity. Lifestyle modification and menstrual health education were recommended. <sup>(12)</sup>

### Implications of the study

Nurses can educate adolescent girls regarding menstrual health, nutrition, and weight management. The findings can help nursing students understand the relationship between BMI and menstrual health. School health programs can be organized to promote awareness regarding menstrual health. Further studies can be conducted with larger samples and different settings.

### Limitation

The study was limited to selected schools only. Small sample size may limit generalization. Data depended on self-reported menstrual problems. The study duration was limited.

### Conclusion

The present study was conducted to assess the relationship between menstrual problems and Body Mass Index (BMI) among adolescent girls in selected schools of Tamil Nadu and Odisha. Adolescence is a crucial period of physical and reproductive development, and menstrual health plays a significant role in the overall well-being of adolescent girls. The findings of the study revealed that a considerable proportion of adolescent girls experienced various menstrual problems such as dysmenorrhoea, irregular menstruation, and heavy menstrual bleeding. The assessment of Body Mass Index indicated that some adolescents were underweight, while others were overweight or obese.

### Funding

Self

### Conflicts of interest

The writer reports no conflicts of interest.

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### Data Availability

The data is available and can be accessed with a reasonable request.

### Abbreviations

BMI – Body Mass Index, WHO – World Health Organization, PMS – Premenstrual Syndrome, SD – Standard Deviation, df – Degree of Freedom,  $\chi^2$  – Chi-Square.

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