**Research Article**

# Menstrual Cycle Length and Dysmenorrhea in Female Adolescents Aged 9-18 Years

## *Panjang Siklus Menstruasi dan Dismenore pada Remaja Perempuan usia 9-18 tahun*

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## Abstract

**Objective:** To determine the relationship between menstrual cycle length and dysmenorrhea in female adolescents aged 9-18 years in Sang Timur Tomang School West Jakarta.

**Methods:** This study used a cross-sectional study approach to conduct observational analytic research. The study samples were female students aged 9-18 years in Sang Timur Tomang School. Study data were obtained through the Verbal Multidimensional Scoring System (VMSS) questionnaire in Indonesian. The Chi-square test of independence was used to determine the relationship between menstrual cycle length and dysmenorrhea.

**Result:** From a total of 137 respondents, 38% have abnormal menstrual cycle length. Eighty-two-point-seven percent of respondents who have abnormal menstrual cycle length experienced dysmenorrhea, and 17.3% of participants who have abnormal menstrual cycle length did not experience dysmenorrhea. Chi-square test results showed a significant relationship between menstrual cycle length and dysmenorrhea in female adolescents aged 9-18 years in Sang Timur Tomang School West Jakarta (p = 0.005).

**Conclusion:** There is a significant relationship between menstrual cycle length and dysmenorrhea in female adolescents aged 9-18 years in Sang Timur Tomang School West Jakarta.

**Keywords:** dysmenorrhea, female adolescents, menstrual cycle, menstrual cycle length.

## *Abstrak*

***Tujuan:*** *Mengetahui hubungan panjang siklus menstruasi dengan dismenore pada remaja perempuan usia 9-18 tahun di Sekolah Sang Timur Tomang Jakarta Barat.*

***Metode:*** *Penelitian ini menggunakan pendekatan potong lintang dengan melakukan penelitian observasional analitik. Sampel pada penelitian adalah siswi usia 9-18 tahun di Sekolah Sang Timur Tomang. Data penelitian diperoleh melalui kuesioner Verbal Multidimensional Scoring System (VMSS) dalam Bahasa Indonesia. Uji Chi-square digunakan untuk mengetahui hubungan antara panjang siklus menstruasi dengan dismenore.*

***Hasil:*** *Dari total 137 responden, sebanyak 38% memiliki panjang siklus menstruasi abnormal. Delapan puluh dua koma tujuh persen responden yang memiliki panjang siklus menstruasi abnormal mengalami dismenore dan 17,3% responden yang memiliki panjang siklus menstruasi abnormal tidak mengalami dismenore. Hasil uji Chi-square menunjukkan adanya hubungan signifikan antara panjang siklus menstruasi dengan dismenore pada remaja perempuan usia 9-19 tahun di Sekolah Sang Timur Tomang Jakarta Barat (p = 0,005).*

***Kesimpulan:*** *Terdapat hubungan bermakna antara panjang siklus menstruasi dengan dismenore pada remaja perempuan usia 9-18 tahun di Sekolah Sang Timur Tomang Jakarta Barat.*

***Kata kunci:*** *dismenore, panjang siklus menstruasi, remaja perempuan, siklus menstruasi.*

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## INTRODUCTION

Menstruation is a natural phenomenon in women during their reproductive ages. During menstruation, women can experience pain in the area around the abdomen called dysmenorrhea.[1–3] Dysmenorrhea causes negative impacts on female students, specifically in decreased academic performance (88.3%) such as absenteeism, reduced participation and concentration during classes, and limitations in sports, study, and exams.[2] The prevalence of dysmenorrhea reaches 87.5% in Central Jakarta.[4] Dysmenorrhea is more common in female adolescents aged 13-20 years (93.3%) compared to females aged 21-30 years and 31-44 years.[5] Age at menarche is one of the risk factors of dysmenorrhea. A recent study has identified a secular trend of declining age at menarche in Indonesia, from 14.43 to 13.63 years over a decade.[6]

Female adolescents generally have abnormal menstrual cycle length during the first two years after menarche. Entering the third year after menarche, 60-80% of female adolescents will have a normal menstrual cycle length.[7] Abnormal menstrual cycle length and dysmenorrhea are related in certain studies, but the findings are still controversial as its mechanism remains unknown.[8,9] This study was undertaken to see a relationship between menstrual cycle length and dysmenorrhea in female adolescents aged 9-18 years in Sang Timur Tomang School West Jakarta.

## METHODS

This study was a cross-sectional study utilizing an observational technique. All participants will be observed once, and the p-value will be searched to determine the hypothesis test results. The study samples were female students aged 9-18 years in Sang Timur Tomang School West Jakarta. The sampling method used in this study is the total sampling method. The researcher distributed the questionnaire in Google Form to all female students in the 4$^{th}$ to 12$^{th}$ grades at Sang Timur Tomang School. Samples are collected from all respondents who returned the questionnaire and met the inclusion and exclusion criteria. This study has received ethical approval by Atma Jaya Catholic University of Indonesia, Faculty of Medicine and Health Sciences number 01/05/KEP-FKIKUAJ/2021, with a minimum of 97 respondents.

Data were collected in August 2021. Study data were obtained through the Verbal Multidimensional Scoring System (VMSS) questionnaire in Indonesian. Data were processed by the original SPSS Statistics 26 program. The relationship between independent and dependent variables was analyzed using the Chi-square test of independence (CI = 95%, $\alpha$ = 0.05%).

## RESULTS

**Table 1.** Demographic Characteristics of Respondents

| Characteristics | Frequency | (%) |
|---|---|---|
| **Age (y o)** | | |
| 9-11 | 28 | 20.4 |
| 12-14 | 22 | 16 |
| 15-18 | 87 | 63.6 |
| **Age at menarche (y o)** | | |
| < 12 | 74 | 54 |
| 12-15 | 63 | 46 |
| **Body mass index** | | |
| Underweight | 5 | 3.6 |
| Normal | 99 | 72.3 |
| Overweight | 24 | 17.5 |
| Obesity | 9 | 6.6 |
| **Family history of dysmenorrhea** | | |
| Yes | 89 | 65 |
| No | 48 | 35 |
| **Family history of reproductive disorders** | | |
| Yes | 8 | 5.8 |
| No | 129 | 94.2 |
| **Gynecological age** | | |
| > 2 | 79 | 57.7 |
| ≤ 2 | 58 | 42.3 |

Interpretation: most respondents came from the 15-18 years age group, had age at menarche in < 12 years, had normal body mass index (BMI), had a family history of dysmenorrhea, did not have a family history of reproductive disorders, and had gynecological age > 2 years. The average respondents' age is 14.42 years, with the average age at menarche and gynecological age are 11.42 years and 3 years.

**Table 2.** Respondents' Characteristics of Menstrual Cycle Length and Dysmenorrhea

| Characteristics | | Frequency | % |
|---|---|---|---|
| **Menstrual cycle length** | **days** | | |
| Normal | | 85 | 62 |
| Abnormal | < 24 | 29 | 21.2 |
| | > 38 | 23 | 16.8 |
| Dysmenorrhea | **Grade** | | |
| No | 0 | 43 | 31.4 |
| Yes | 1 | 78 | 56.9 |
| | 2 | 16 | 11.7 |

Interpretation: from 137 respondents, 38% of respondents had abnormal menstrual cycle length, and 68.6% of respondents experienced dysmenorrhea.

**Table 3.** Bivariate Analysis Results for Relationship between Body Mass Index, Family History of Dysmenorrhea, and Abnormal Menstrual Cycle Length with Dysmenorrhea

| Variable | | Dysmenorrhea | | Total (%) | *P-value* |
|---|---|---|---|---|---|
| | | Yes (%) | No (%) | | |
| Body mass index | Normal | 66 (66.7) | 33 (33.3) | 99 (72.3) | |
| | Abnormal | 28 (73.7) | 10 (26.3) | 38 (27.7) | 0.428 |
| Family history of dysmenorrhea | No | 24 (50) | 24 (50) | 48 (35) | |
| | Yes | 70 (78.7) | 19 (21.3) | 89 (65) | 0.001 |
| Menstrual cycle length | Normal | 51 (60) | 34 (40) | 85 (62) | |
| | Abnormal | 43 (82.7) | 9 (17.3) | 52 (38) | 0.005 |

Interpretation: the results of the Chi-square test showed a significant relationship between family history of dysmenorrhea (p = 0.001) and menstrual cycle length with the presence of dysmenorrhea (p = 0.005).

**Table 4.** Bivariate Analysis Results for Relationship between Gynecological Age with Menstrual Cycle Length

| Gynecological Age | Menstrual Cycle Length | | Total (%) | *P-value* |
|---|---|---|---|---|
| | Normal (%) | Abnormal (%) | | |
| > 2 | 55 (69.6) | 24 (30.4) | 79 (57.7) | |
| ≤ 2 | 30 (51.7) | 28 (48.3) | 58 (42.3) | 0.033 |
| Total | 85 (62) | 52 (38) | 137 (100) | |

Interpretation: the results of the Chi-square test showed a significant relationship between gynecological age with menstrual cycle length (p = 0.033).

## DISCUSSION

Menstruation is a physiological process in women that normally occurs every 24-38 days as a result of the absence of pregnancy. Women can experience discomfort and pain in the area around the abdomen during this period, called dysmenorrhea.[1–3,10]

The prevalence of dysmenorrhea varies from 16-91% and reaches 87.5% in Central Jakarta. [4,11] Dysmenorrhea and abnormal menstrual cycle length are more common in female adolescents, and the relationship between the two variables is still controversial.[5,7–9] Age at menarche, body mass index (BMI), family history of dysmenorrhea, and gynecological age are risk factors for dysmenorrhea and menstrual cycle length.[12] The study identified a secular trend of declining age at menarche in Indonesia from 14.43 to 13.63 years over a decade.[6]

### Demographic characteristics of respondents

Our study found that our respondents' average age at menarche is 11,42 years and 54% of our respondents experienced menarche at the age of < 12 years, which is considered early menarche. These results were consistent with previous studies about a secular trend of declining age at menarche and early menarche phenomenon in Indonesia.6,13 Urbanization, increased BMI, and sedentary lifestyle are the main factors. Physical activity can increase the metabolism and excretion of the estrogen so that the concentration of endogenous estrogen decreases. Estrogen plays a role in females' puberty, which is marked by menarche. Decreased physical activity causes endogenous estrogen concentrations to increase, resulting in early menarche and precocious growth.[14,15]

Lack of physical activity is closely related to increased BMI, which is also a risk factor for early menarche. Previous studies concluded that women with a high BMI were more likely to experience early menarche because of hyperandrogenism.[14,15] Therefore, an increase in phospholipids and arachidonic acid in women with an excess BMI produces excess prostaglandins, which is causing dysmenorrhea.[12] Our study found that most respondents (72.3%) had normal BMI, and 33 out of 137 respondents (24,1%) had overweight and obese BMI. Of the total 33 respondents who had high BMI, 26 respondents (78.8%) experienced early menarche. Furthermore, there is no relationship between BMI with dysmenorrhea (p = 0,428), which is consistent with the previous study (p = 0.636).[8]

The bivariate analysis showed a significant relationship between family history of dysmenorrhea with dysmenorrhea (p = 0.001). Seventy out of 137 respondents (78.7%) who had a family history of dysmenorrhea also experienced dysmenorrhea. Consistent with the previous study, a girl who has a mother or sisters who experience dysmenorrhea is more likely to experience dysmenorrhea. Family history as a

risk factor includes genetics and the same daily lifestyle in the family.[11,16,17]

Our study also identified the gynecological age of our respondents, which reflects the maturity of the function of the female reproductive organs. This is because our respondents were female adolescents aged 9-18 years. Most of them had just experienced menarche and had abnormal menstrual cycle length, so it's crucial to assess the reproductive organ function's maturity through gynecological age. Gynecological age indirectly strengthens the relationship between menstrual cycle length and dysmenorrhea in this study.[7,18] We found that most respondents (57.7%) had a gynecological age > 2 years with an average of 3 years. Bivariate analysis showed that there is a strong relationship between gynecological age and menstrual cycle length ($p = 0.033$). Our findings indicate that respondents with gynecological age > 2 years also have normal menstrual cycle length. Generally, the menstrual cycle length of women with a gynecological age ≤ 2 years is abnormal. Entering the third year after menarche, 60-80% of women will have a normal menstrual cycle length because the HPO (hypothalamus-pituitary-ovarian) axis is gradually maturing.[7,18]

**Menstrual Cycle Length**

Our study found that 52 respondents (38%) have an abnormal menstrual cycle length and 85 respondents (62%) have normal menstrual cycle length. Previous literature from The American College of Obstetricians and Gynecologists (ACOG) and a study identified that abnormal menstrual cycle is more common in female adolescents. As mentioned before, this phenomenon is caused by immaturity of the HPO axis that occurs during puberty. Even though the girl has experienced menarche, it does not mean that the HPO axis has fully developed. Therefore, the immaturity of HPO causes the length of the menstrual cycle to be shorter (< 24 days) or longer (> 38 days) than normal.[7,18–20]

The neuroendocrine axis of a female's puberty takes time to reach its maturity. Puberty begins with the first release of gonadotropin-releasing hormone (GnRH) from the hypothalamus, which induces the production of follicle-stimulating hormone (FSH) and luteinizing hormone (LH) from the anterior pituitary. During puberty, generally the feedback mechanism and the response of the ovarian follicle to hormonal stimulation are still not sensitive. This causes the luteal phase of the ovarian cycle to be longer and the failure to form the pre-ovulatory follicles that (normally) should produce estrogen to provide positive feedback on GnRH, causing an LH surge and ovulation to occur. This failure causes ovulation not to occur, thereby inducing endometrial proliferation even without progesterone as a nutrient. In facts that the corpus luteum should produce progesterone after ovulation. Therefore, the occurrence of the anovulatory cycle causes abnormal menstrual cycle length in female adolescents. This phenomenon will improve with the continuous GnRH stimulation over time, which will make the ovarian follicles more sensitive.[21,22]

Most respondents in this study (62%) had a normal menstrual cycle length. This finding is thought to be because most respondents are from the 15-18 years age group (Table 1), which is approaching late adolescence. This group has gynecological age > 2 years and a mature HPO axis, so they have a normal menstrual cycle length.[20,22]

**Dysmenorrhea based on VMSS**

Our study found that most respondents (68.6%) experienced dysmenorrhea. This prevalence is lower which identified the prevalence of dysmenorrhea in female adolescents in Central Jakarta reached 87.5%. The difference in prevalence is due to the difference in the age range between the two studies. Involved female adolescents aged 11-22 years, which means the youngest age in our study is 2 years younger (9 years). In addition, 37 out of 137 respondents (27%) in this study had gynecological age ≤ 1 year. Considering that the emergence of dysmenorrhea occurred 6-12 months after menarche, so there is a possibility that dysmenorrhea in this group of respondents has not been detected, resulting in the lower prevalence of dysmenorrhea. On the other hand, the prevalence of dysmenorrhea in this study was higher than the prevalence of dysmenorrhea in Indonesia, which was 54.89%.[4]

In Nigeria identified that dysmenorrhea is more common in female adolescents, where the majority (93.3%) of female adolescents of their study experienced dysmenorrhea. These results support the fact that our respondents were female adolescents aged 9-18 years, and most respondents experienced dysmenorrhea.[5]

**The Relationship between Menstrual Cycle Length and Dysmenorrhea**

Bivariate analysis of the relationship between menstrual cycle length and dysmenorrhea showed that the p-value was 0.005 ($p < 0.05$). These findings indicate a significant relationship between menstrual cycle length and dysmenorrhea in this study. Female adolescents who have an abnormal menstrual cycle length are more likely to experience dysmenorrhea. Our results are consistent which concluded that there was a relationship between menstrual cycle length and dysmenorrhea. Their study involved 354 women and identified that women with menstrual cycle length > 35 days or longer than normal were more likely to experience dysmenorrhea.[8] This conclusion is also supported which identified that women with menstrual cycle length > 29 days were more likely to experience dysmenorrhea.[23] Otherwise, our findings contradict the study which identified that there was no relationship between menstrual cycle length and dysmenorrhea.[16,24]

Pathophysiology of dysmenorrhea begins with the degradation of the unfertilized corpus luteum into corpus albicans, resulting in the reduction of progesterone production. Then the low progesterone level causes the shedding of the endometrial wall and activation of the cyclooxygenase (COX) and lipooxygenase (LOX) pathways. These two pathways then produce prostaglandins ($PGF_{2a}$, $PGE_2$), prostacyclin, thromboxane A2, and leukotrienes. These substances then cause the vasoconstriction of endometrial blood vessels, stimulate myometrial muscle contraction, and increase hypersensitivity to central and peripheral pain stimuli, resulting in recurrent dysmenorrhea.[25,26]

A study identified that women with abnormal menstrual cycle length were more likely to experience anovulation and decreased progesterone secretion. The decrease in progesterone secretion leads to excessive activations of the COX and LOX pathways, resulting in the excessive production of prostaglandins, prostacyclins, $A_2$ thromboxane, and leukotrienes. The increased levels of these substances are associated with increased intensity of dysmenorrhea.[27,28]

## CONCLUSIONS

Based on the results of this study, it can be concluded that 68,6% of respondents experienced dysmenorrhea, and 32% of respondents had abnormal menstrual cycle length. There is a relationship between menstrual cycle length and dysmenorrhea in female adolescents aged 9-18 years in Sang Timur Tomang School West Jakarta.

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