



## **Analysis of Factors Affecting the Stress Level and Self-Medication Practice in Primary Dysmenorrhea in Adolescents during COVID-19 Pandemic**

Nurul Kusumawardani<sup>1\*</sup>, Endang Darmawan<sup>2</sup>, Jasmine Amira Hatisuci<sup>2</sup>, Iftita Nuratika Ramadhanti<sup>2</sup>, Rahma Sakti Oktavia<sup>1</sup>, Very Ainun Fauziah<sup>1</sup>, Trisna Styawaty<sup>1</sup>, Ratih Nugraeni<sup>1</sup>

<sup>1</sup>Pharmacy Study Program, Faculty of Health Sciences, Alma Ata University, Yogyakarta, Indonesia

<sup>2</sup>Faculty of Pharmacy, University of Ahmad Dahlan, Yogyakarta, Indonesia

\*Corresponding author: [nurul.kusumawardani@almaata.ac.id](mailto:nurul.kusumawardani@almaata.ac.id)

Submitted: 30 August 2021

Accepted: 22 June 2022

Published: 31 August 2022

### **Abstract**

**Background:** During the novel coronavirus (COVID-19) pandemic, reports of adolescent pain and worsening of the menstrual cycle increased with increasing stress levels. **Objective:** Analysis of determinant factors that influence the ability to self-medication for menstrual pain, including socio-demography and medical history, to determine the effect of stress levels on the menstrual cycle of adolescent women during the COVID-19 pandemic. **Methods:** The method is descriptive observational, through a cross-sectional study on adolescent females in Indonesia was conducted in October-November 2020. Data collection through a simple survey method using a self-medication online questionnaire survey and the Kessler psychological distress scale (KPDS) by consecutive sampling technique. About 258 women agreed to participate in the study. The results are presented in the form of frequency and percentage (%), and the determinants are analyzed using  $\chi^2$ -test and binary logistic regression models. **Result:** About 78.3% of respondents had stress during the pandemic COVID-19 with primary dysmenorrhea (70.2%), and 58.9% of respondents had low self-medication for managing primary dysmenorrhea. The predictors of self-medication understanding were the mother's education level and history of menstrual pain ( $p$ -value = 0.045; 0.005). In addition, respondents' stress levels during the COVID-19 pandemic affected their menstrual cycles (OR=5.110; 95% CI: 1.767–14.782,  $p$ -value=0.003). **Conclusion:** The role of pharmacists in the community and mothers as pioneers of family health is vital in increasing the understanding and implementation of the practice of self-medication for primary dysmenorrhea. This role needs to manage the stress of adolescent women. It can affect the reduction in the menstrual cycle, especially during the COVID-19 pandemic.

**Keywords:** COVID-19 pandemic, dysmenorrhea, menstrual cycle, pandemic stress, self-medication

### **How to cite this article:**

Kusumawardani, W., Darmawan, E., Hatisuci, J.A., Ramadhanti, I.N., Oktavia, R.S., Fauziah, V.A., Styawaty, T. & Nugraeni, R. (2022). Analysis of Factors Affecting the Stress Level and Self-Medication Practice in Primary Dysmenorrhea in Adolescents during COVID-19 Pandemic. *Jurnal Farmasi Dan Ilmu Kefarmasian Indonesia*, 9(2), 155-167. <http://doi.org/10.20473/jfiki.v9i22022.155-167>

## INTRODUCTION

In Indonesia, the Novel Coronavirus-19 (COVID-19) infection has occurred since March 2, 2020, and is currently regarded as a global threat (Nugraha et al., 2020). This condition leaves an impact on many things, one of which is secondary health problems in women. Stress as a result of the pandemic causes various issues such as decreased movement in activities, online learning, layoffs, family financial problems, and isolation due to the COVID-19 infection. These become challenges for millions of women of childbearing age. Pandemic stress can disrupt physiological processes related to fertility, such as the menstrual cycle and genital tract health (Aolymat, 2021). The pandemic worsens the quality of social relationships, causes the lack of social support and knowledge related to the health impacts of psychological conditions such as loneliness, and worsens mental and physical health problems (Cohut, 2021). Menstruation is a normal physiological state important in the life cycle and is an integral part of women's health (Thiyagarajan et al., 2020). It indicates the reproductive system's maturity, which can affect most women's physical, mental, and social health (Critchley et al., 2020).

The problem that commonly occurs in almost 50%-80% of women is excessive menstrual pain or dysmenorrhea. The condition of dysmenorrhea is different from that of premenstrual syndrome (PMS), and it can be categorized into two types: primary and secondary (Arafa et al., 2018). Secondary dysmenorrhea is caused by an identifiable pathological condition such as intrauterine devices, endometriosis, inflammation of the pelvis, or the presence of ovarian cysts. Meanwhile, primary dysmenorrhea is associated with no pelvic or hormonal health problems, and this type is most commonly found in adolescent girls (Miller, 1988). The occurrence of dysmenorrhea can be followed by menstrual bleeding and abnormal menstrual cycles. This condition can be associated with pandemic stress which affects menstrual patterns (Demir et al., 2021; Phelan et al., 2021; Ozimek et al., 2022). The adrenal gland will release the cortisol hormone to control the resulting stress response. It will suppress the production of reproductive hormones from the ovaries (Thau et al., 2021). Menstrual pattern changes include abnormal menstrual periods, heavy menstrual flow, abnormal cycles, absence of menstruation for several months, and increased pain during menstruation (Ansong et al., 2019).

These studies linked stress levels during COVID-19 to the menstrual cycle. Research conducted by Ozimek (2022) shows the implications of the COVID-19 pandemic on the menstrual cycle. This happened due to the low mental health outcome in women, which interferes with the women's reproductive function and increases stress conditions (Ozimek et al., 2022). This research seems consistent with that of Demir et al. (2021), who argue that during the COVID-19 pandemic, there was an increase in anxiety and stress levels due to the COVID-19 outbreak, which affected the menstrual cycle characteristics. The other influencing factors are the variance of late sleeping time (Dhawan & Hernole, 2020), lifestyle changes, and increased stress during lockdown that lead to the abnormal menstrual cycle (Bruinvels et al., 2021; Takmaz et al., 2021). Research by Nguyen et al. (2021) shows that the COVID-19 pandemic does not cause changes in women's menstrual cycle and ovulation. However, some women experience abnormalities during the pandemic. This condition is influenced by education level and occupation, where the respondents in this study were mostly well educated (high school – bachelor's degree), had parents (mother) aged 30 years and had a job (not a housewife) (Nguyen et al., 2021). Thus, age, education, maturity, and work will affect women's psychological condition during the COVID-19 pandemic. In addition, research by Nareswari et al. (2021) showed no significant relationship between stress levels during the Covid-19 pandemic and changes in the menstrual cycle (Nareswari et al., 2021).

Menstruation problems significantly negatively impact the socioeconomic burden, one of which is health services (United Nations, 2020). This is due to the fear of contracting COVID-19, the high cost of therapy, and inadequate literacy about self-medication, all of which will worsen the health situation. Self-medication through the prudent, autonomous, and reasonable use of herbal and chemical treatments and the appropriate selection of medicines are feasible solutions to these problems. Self-medication is an individual effort to overcome the disease symptoms without consulting a doctor or asking for a doctor's prescription for treatment (Bennadi, 2014). The rational use of medicines is needed by every woman when dealing with pain or discomfort due to menstruation. Before the COVID-19 outbreak, the prevalence of acute-moderate menstrual pain in women diagnosed with primary dysmenorrhea occurred in approximately three-quarters of all young women under 25 worldwide (Armour, Parry, Manohar,

et al., 2019). Menstrual pain can be accompanied by cramps, back and thigh pain, headaches, diarrhoea, nausea, and vomiting (Hennegan et al., 2019). This condition will encourage women to find a medicine that provides quick healing regardless of the side effects.

Non-pharmacological strategies such as consuming traditional herbs and controlling physical or psychological activities through meditation and yoga can be used as an alternative to self-medication before deciding to take analgesics as pain relievers (Armour, Parry, Al-Dabbas, et al., 2019). However, these strategies are still rarely applied by adolescent females (De Sanctis et al., 2020; Parra-Fernández et al., 2020). Most prefer to consume instant drinks claimed to have pain relief or even take over-the-counter (OTC) analgesics, such as ibuprofen and or acetaminophen, regardless of the recommended dose and side effects (Matyas et al., 2015). The rational behaviour of self-medication is also determined by education, health workers, parents' role and social support. This collaboration will reduce the barriers that cause inaccuracies in drug selection and factors that trigger menstrual problems, such as good stress management, especially during this pandemic (Rifati & Sudiarti, 2020).

The low understanding of adolescent women toward self-medication as an effective self-care strategy will impact poor pain management. As a result, this study aims to identify the prevalence and factors that influence pandemic stress and its relationship to the changes in menstrual patterns. This study serves as the basis for promotive and preventive measures conducted by health workers, one of which is a pharmacist because it is part of the initial screening and assessment factors that can affect menstrual patterns and health problems. A possible effort that can be carried out in pharmaceutical education for adolescent females based on the causative factors so that the quality of life related to women's health during the COVID-19 pandemic will be well controlled.

## METHODS

### Research Design

A cross-sectional online survey of adolescent females aged 15 to 21 in Indonesia was conducted in October-November 2020 using a consecutive sampling technique. The inclusion criteria in this study were adolescent females aged 15-21 years, menstruated, with no comorbidities such as cardiovascular disease, haematology, acute kidney failure, end-stage renal

disease, and cancer. The exclusion criteria were those who did not answer all questions in the online survey. The online questionnaire had undergone expert judgment evaluation and had been given informed consent.

The total population of adolescent females in Indonesia in 2019 was 10.816.900 (Badan Pusat Statistik, 2020). The sample size was calculated based on the population frequency to maintain statistical power for the statistical tests used in the data analysis. The number of samples was determined based on the overall population with a 95% confidence interval, obtaining a minimum sample size of 255 with the OpenEpi Version 3 application, an open-source calculator. The population size (for the finite population correction factor) (N) was 10.816.900, and the percentage (%) frequency of the hypothesized outcome factor in the population was (p): 21% +/- 5, with the confidence interval as +/- 5% of 100 (absolute +/- %) (d), and the design effect (for the DEFF cluster survey) was one so that a minimum sample size of 255 was obtained with a 95% confidence interval. Until the end of the study, 258 participants who 258 participants were willing to participate in the survey through online informed consent.

### Data collection method

The data was collected through online surveys from October-November 2020. Privacy and anonymity of survey responses were ensured for all participants. Invitations were announced on the social media used by the researchers to be spread based on the study's inclusion criteria. Participants were also able to invite other friends to participate in the study. The research survey was completed using a Google form linked to the participant's email to prevent duplication. Approval and search instructions are available on the Google Form's home page.

The instruments employed in this study were a questionnaire on sociodemographic characteristics (age, gender, level of education, parents' occupation, location, and parents' income), a health assessment questionnaire, a self-medication questionnaire in overcoming menstrual pain pharmacologically and non-pharmacologically, and Kessler Psychological Distress Scale (KPDS) to determine the stress level. This questionnaire had undergone validity and reliability measurement (Table S1). Based on Cronbach's Alpha measurement, the KPDS questionnaire has a reliability value of  $\alpha > 0.8$  (Tran et al., 2019). A questionnaire on the self-medication practice for primary dysmenorrhea

(Table S2) had passed the expert judgment by doctors, pharmacists, and psychologists. Furthermore, validation and reliability tests were conducted on 30 junior and senior high school students who were not involved as participants in the study. The Cronbach's Alpha analysis results found that all items were declared reliable with  $\alpha > 0.060$ . Data obtained directly from the participants, including the sociodemographic characteristics, COVID-19's impact on the family economy, health assessment (history of illness, history of dysmenorrhea, menstrual pain based on a visualizable scale with online emoticon, duration, and menstrual cycle), questionnaire of self-medication to treat menstrual pain both pharmacologically and non-pharmacologically, and a stress level questionnaire based on KPDS during this COVID-19 pandemic. The procedure employed in this study is presented in Figure 1.

### Statistical analysis

The respondent's socio-democratic characteristics and basic health assessment were analyzed using descriptive statistics and were presented in tabular form with variable frequency and percentage (%). Chi-square test as a univariate analysis was used to determine the effect between the independent and dependent variables (stress level, menstrual cycle, and the self-medication ability for menstrual pain), and a p-value  $\leq 0.050$  was obtained, indicating that the result was statistically significant. In addition, it was also utilized to detect the candidate's variables for the binary logistic regression test on self-medication (p-value  $\leq 0.250$ ). For multivariate analysis, binary logistic regression and categorical data on an ordinal/nominal scale were used. It can assess the determining variables of self-medication for menstrual discomfort. If the p-value is less than 0.050, it is considered statistically significant.

### Research ethics

Ethical approval for this study was obtained from the Ethics Committee of Alma Ata University (approval number KE/AA/VIII/10251/EC/2020). The flowchart describing the research procedure can be seen in Figure 1.

## RESULTS AND DISCUSSION

### Assessment of adolescent women's socio-demography and health during the COVID-19 pandemic

COVID-19 has an impact on adolescents' health quality and stress levels (Ozimek et al., 2022). For some women, this condition affects their menstrual cycle. Prolonged periods of stress in women can suppress the

HPA axis, which may affect follicle-stimulating and luteinizing hormones (FSH and LH). This condition affects females' reproductive health during the pandemic (Sharp et al., 2021; Edelman et al., 2022). In addition to hormonal factors, sociodemographic characteristics such as age, parental occupations, educational levels, and income can affect stressful conditions during the COVID-19 pandemic. Research by Caycho-Rodríguez et al. (2021) shows that the COVID-19 pandemic significantly and positively predicted anxiety and depressive symptoms influenced by sociodemographic factors (Caycho-Rodríguez et al., 2021). Therefore, this study descriptively analyzed the prevalence and relationship between stress levels and menstrual cycles according to sociodemographic characteristics.

The assessment results of the sociodemographic characteristics and health history in this study are shown in Table 1. Most respondents had a mean age ( $\Delta \pm SD$ ) of  $15.53 \pm 0.63$  and belonged to the young adult category ( $17.14 \pm 0.43$ ). The fathers' employment status in this study was divided into permanent and temporary workers. The difference lies in the income generated each month. As for the mothers' social status, almost half of them were homemakers. The respondents' parents' education level was mostly higher in diplomas and bachelor's degrees. Parents' education and work are crucial for children's health, especially in the transition period to adapt to new habits during the COVID-19 pandemic. Based on the occupation and educational background, 45% of the total sample was affected by economic recession during this pandemic. This study shows that not all sociodemographic characteristics and health history assessments affect the respondents' stress analysis and menstrual cycles during the COVID-19 pandemic (Table 1).

Genital and reproductive health in adolescence is regarded as necessary. Sociodemographic characteristics and health history can influence both. They can also affect adolescent female hormones psychologically and/or physically. The bivariate analysis showed that the respondents' stress levels influenced menstrual duration. The pandemic stress may bring about this condition in women during adolescence. This stress level was experienced by 78.30% of respondents based on the KPDS questionnaire result. Although there is no high risk of death in teenagers compared to adults and geriatrics, they risk experiencing a high-stress level. This condition corroborates with the

result obtained from this study, where most of the respondents experienced pandemic stress. Changes in their daily activities during the pandemic leave an impact both psychologically and physiologically (Fitzsimmons, 2019; Thibaut & van Wijngaarden-Cremers, 2020). These results are in line with the first non-representative research from China, India, Brazil, the United States, Spain, Italy, and Germany, showing that teenagers during this pandemic tend to have negative mental health (Ravens-Sieberer et al., 2021).

This condition affects the respondents' menstrual duration with an odds ratio (OR) value of 95% CI 1,250 (1.122-1.393). This means that people with pandemic stress have a 1.25-times risk of experiencing irregular menstrual periods compared to those without pandemic

stress. Furthermore, problems related to menstrual duration are linked to changes in the menstrual cycle (Rafique & Al-Sheikh, 2018; Edelman et al., 2022). Respondents with irregular menstrual periods had an average menstrual duration of  $28.00 \pm 4.91$  days, while the average cycle and duration for normal menstruation was  $26.00 \pm 4.51$  days with an OR value of 95% CI 3.071 (1,570-6,010). These results indicate that individuals with irregular menstrual duration have a 3.07 times greater risk of experiencing problems related to the menstrual cycle than those with normal menstrual duration. This shows that stress levels may affect menstrual cycles during the COVID-19 pandemic, with [OR] = 5.110; 95% CI 1.767–14.782, p-value=0.003).

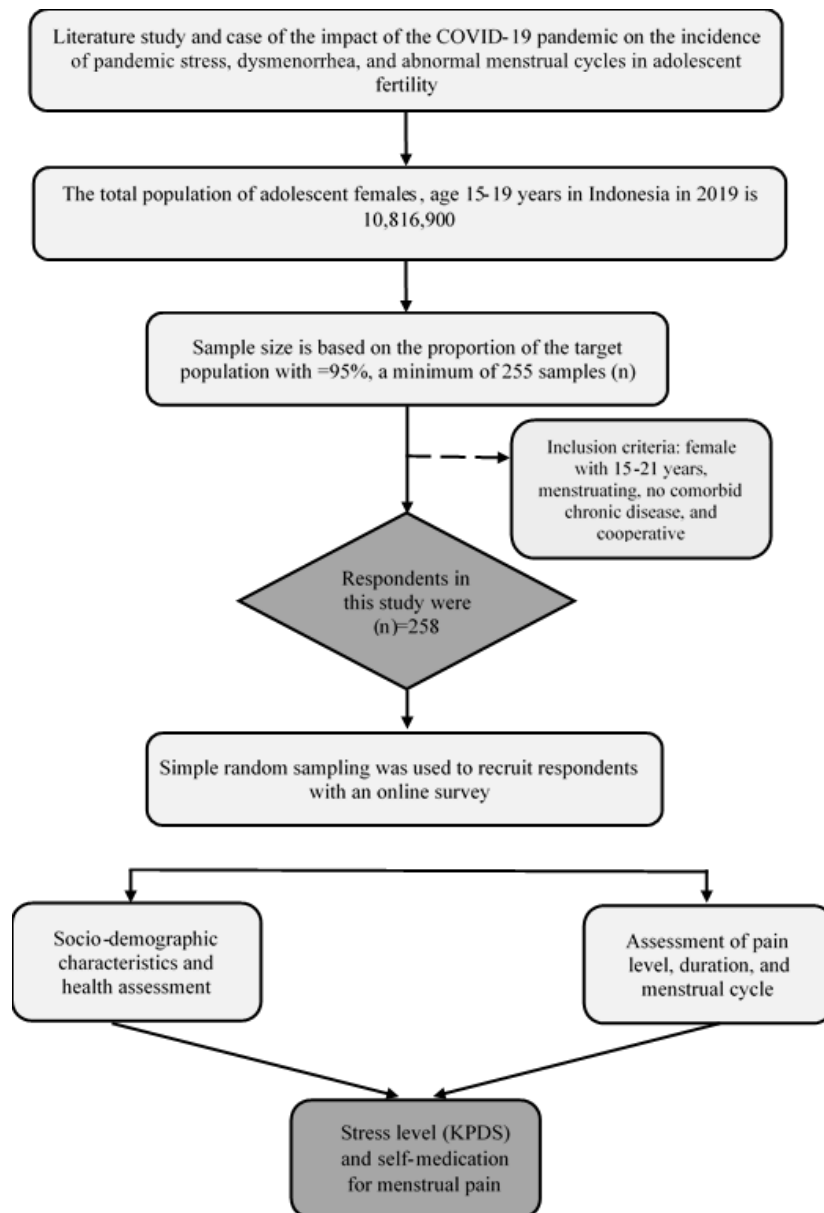
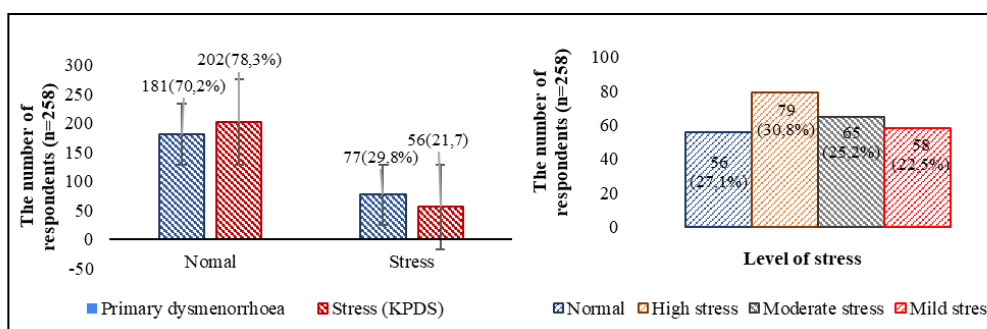


Figure 1. Research procedure

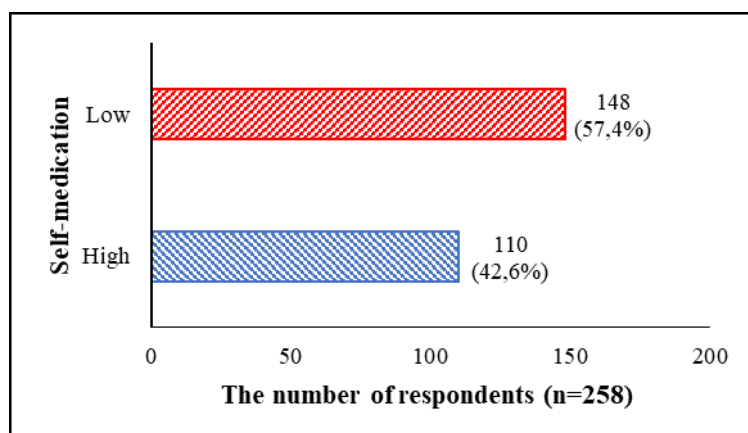
**Table 1.** Prevalence of stress levels and menstrual cycle based on sociodemographic characteristics and health of respondents

Socio-demographic & health characteristics	Total (n=258) n (%)	Stress analysis - based on Kessler (n=258)		$\chi^2$	p-value	Menstrual Cycle (n=258)		$\chi^2$	p-value
		No n (%)	Yes n (%)			Normal n (%)	Abnormal n (%)		
<b>Age (years)</b>									
15-17	173(67.1)	35(62.5)	138(68.3)	0.672	0.413	132(67.0)	41(67.2)	0.001	0.975
18-21	85(32.9)	21(18.3)	64(66.6)			65(33.0)	20(32.8)		
<b>Father's job description</b>									
Permanent	132(51.2)	27(48.2)	105(52.0)	0.249	0.618	98(49.7)	34(55.7)	0.669	0.413
Temporary	126(48.8)	29(51.8)	97(48.0)			99(50.3)	27(44.3)		
<b>Mother's job description</b>									
Workers'	127(49.2)	33(58.9)	94(46.5)	2.695	0.101	100(50.8)	27(44.3)	0.787	0.375
Housewives'	131(50.8)	23(41.1)	108(53.5)			97(49.2)	34(55.7)		
<b>Father's education</b>									
Primary and secondary	18(7.0)	4(7.1)	14(6.9)	0.003	0.959	13(6.6)	5(8.2)	0.183	0.669
Higher	240(93.0)	52(92.9)	188(93.1)			184(93.4)	56(91.8)		
<b>Mother's education</b>									
Basic	53(20.5)	12(21.4)	41(20.3)	0.034	0.853	158(80.2)	47(77.0)	0.284	0.594
Higher	205(79.5)	44(78.6)	161(79.7)			39(19.8)	14(23.0)		
<b>Economic impact</b>									
Yes	116(45.0)	30(53.6)	86(42.6)	2.143	0.143	89(45.2)	27(44.3)	0.016	0.900
No	142(55.0)	26(46.4)	116(57.4)			108(54.8)	34(55.7)		
<b>Menstruation duration</b>									
Normal	211(81.8)	53(94.6)	158(78.2)	7.939	0.005*	170(86.3)	41(67.2)	11.383	0.001*
Abnormal	47(18.2)	3(5.4)	44(21.8)			27(13.7)	20(32.8)		
<b>Menarche</b>									
≤13 year	208(80.6)	7(43.8)	54(87.1)	14.020	0.001*	44(77.2)	17(81.0)	0.127	0.721
>13 year	50(19.4)	9(56.3)	8(12.9)			13(22.8)	4(19.0)		

n= number of samples in the study;  $\chi^2$ =value Pearson Chi-Square; \*p-value<0.050 a significant relationship between variables in demographics and health with stress and or the menstrual cycle



**Figure 2.** Primary dysmenorrhea prevalence and stress levels based on Kessler (KPDS questionnaire)



**Figure 3.** Primary dysmenorrhea self-medication ability during the COVID-19 pandemic

Problems in the menstrual pattern are associated with the level of stress during the COVID-19 pandemic (Edelman et al., 2022). Most respondents (80.6%) had a regular menstrual duration during the pandemic with menarche that occurs at the age of 13. The age of menarche suggests the early age of women experiencing menstruation. This study relates to the pandemic stress experienced by the participants. Statistically, it shows the relationship between the two variables with OR 95%CI power value of 1.881 (1.127-3.140). Adolescent females who experience menarche at a relatively young age have a 1.88 times greater risk of having poor stress management characterized by an increased stress level compared to that of general age. Commonly, women experience menarche at 10-16 years old, and some start at 14-17 years old (middle adolescence).

**The prevalence of primary dysmenorrhea and stress levels during the COVID-19 pandemic**

From the results of this study, the prevalence of primary dysmenorrhea is shown in Figure 2. It reveals that based on the measurement of stress levels using the KPDS questionnaire, primary dysmenorrhea occurred in respondents who experienced stress. A total of 143 (55.40%) respondents experienced primary dysmenorrhea with increased stress levels during the COVID-19 pandemic.

Problems in the menstrual cycle can be caused by psychological stress. The pandemic stress that occurred in most respondents affected their menstrual patterns, such as the menstrual cycle and primary dysmenorrhea. The indirect effects came from stress, anxiety, malnutrition, and physical activity, which affect reproductive health and menstrual patterns (McNamara et al., 2020). The menstrual cycle is controlled by the hypothalamus-pituitary-ovarian complex's brain centre, which has a positive and negative feedback mechanism.

This complex is influenced by the stress conditions experienced by the respondents.

In addition, adequate energy plays a role in the availability of gonadotropin-releasing hormone (GnRH) secretion in the hypothalamus. It will alter the release of luteinizing hormone (LH) and follicle-stimulating hormone (FSH) from the pituitary. It reduces estrogen and progesterone levels (Mikhael et al., 2019). Some hormonal disorders can influence the menstrual cycle, duration, and primary dysmenorrhea. Menstrual cycles last 25-30 days in most women (Ferin, 2008). In this study, 61 respondents (23.60%) had menstrual cycles over 30 days. Since the outbreak of the COVID-19 pandemic, menstrual changes have been shown to occur in most women, including duration, frequency, regularity of the cycle, the volume of bleeding, and dysmenorrhea (Yamakoshi, 2020; Aolymat et al., 2022). It is associated with COVID-19 or factors related to psychological stress and changes in healthy behaviours (Sharp et al., 2021b). The level of anxiety and psychological stress may affect a woman's menstrual cycle (Phelan et al., 2021; Jawad et al., 2021). Specific stressors that affect stressful conditions for adolescents during the COVID-19 pandemic are difficulties in accessing health services, changes in the family economy caused by the pandemic, distance learning and parental work (Al Dhaheri et al., 2021). In addition, stress not only occurs due to the pandemic but also due to parenting patterns, parents' occupation and economy, relationship status, nutritional status, and environmental conditions (Bae et al., 2018; Haeriyah et al., 2019; Yilmaz et al., 2021).

Stress level, menorrhagia, and menstrual pain are related to each other (Yamamoto et al., 2009), while the menarche and premenstrual symptoms are significant determinants of primary dysmenorrhea (p-value=0.012)

(Singh et al., 2015). These results are in line with this study. Menstrual cramps experienced by the respondents underwent an increase in pandemic pressure. Research conducted by Grandi et al. (2012) at the University of Modena and Reggio Emilia in April 2010 found that 55.2% of 500 women would consider the need for self-medication to treat the cause of menstrual pain ( $p$ -value $<0.001$ ) (Grandi et al., 2012). Although menstrual history becomes the determinant that affects the ability to conduct self-medication practice for menstrual pain, the participant's proper self-medication is generally low. Chen et al. (2019) stated that 34.8% of 2555 women knew how to self-medicate, 15.6% of whom used modern medicine with synthetic drugs, and only 8.60% were able to self-medicate for menstrual pain through the use of traditional herbs. Individuals with greater pain severity were more likely to attempt self-medication (OR = 7.01; 95% CI 4.50-10.91), used complementary therapies (OR = 2.64; 95% CI 1.70-4.10), and sought advice from a health professional (OR = 5.93; 95% CI 3.80 to 9.24) (Chen et al., 2019).

#### **The prevalence of understanding primary dysmenorrhea and self-medication during the COVID-19 pandemic**

The prevalence of adolescent females related to the understanding of self-medication ability by using over-the-counter and non-pharmacological drugs using herbal plants for treating dysmenorrhea is relatively low (Figure 3). Respondents' self-medication efforts need to collaborate with pharmacists, parents, social environment, and other health professionals who provide education on rational self-medication. In this case, individuals will take responsibility for their health and well-being, including maintaining their physical and mental health (Esfandiari et al., 2018; Rutter, 2015).

A cut-off point was used to determine, categorize or continuously dichotomize the ability level to self-medicate primary dysmenorrhea (Table S2). The cut-off point was based on the distribution of the total score of the questionnaire. The scores' distribution based on the data's normality was analyzed to define two cut-off points (Oliveira et al., 2015). The Kolmogorov-Smirnov test was used to analyze the normality of the data, and the result indicates that the data were not normally distributed. Therefore, two cut-off points were made based on the median. The median value of the questionnaire score (Table S2) was 75. If the score  $\geq 75$ , it means that the level of knowledge is high, and if the score is  $< 75$ , then the level of self-medication

understanding is low. The result showed that most of the respondents (57.4%) had a relatively low level of self-medication (Figure 3). This prevalence mainly occurred in middle adolescence, with as many as 104 (60.1%) respondents. While in young adulthood, there were as many as 44 (51.8%) respondents with a low level of ability and 41 (48.2%) respondents with good skills in self-medication for primary dysmenorrhea.

In addition to the self-medication ability to treat menstrual pain caused by primary dysmenorrhea, this study showed that most respondents (57.4%) used non-steroidal anti-inflammatory drugs (NSAIDs) such as mefenamic acid and ibuprofen. Furthermore, the non-pharmacological therapy applied was relaxation with aromatherapy oil and massage to relieve dysmenorrhea pain. The low level of self-medication requires education, especially by pharmacists. However, parents also play a pivotal role. Mothers are pioneers in family health (Parra-Fernández et al., 2020). This is shown by the correlation between a mother's education and the respondent's self-medication ability in this study.

#### **Determinants Factors of Self-Medication to Treat Menstrual Pain during the COVID-19 Pandemic**

This research examines the correlation between all variables (Table 3), including sociodemographic and health assessment results on the respondent's self-medication practice in primary dysmenorrhea. The main influencing factors were analyzed, and the sociodemographic characteristics and health history of the respondents or their parents were found (Table 3). Based on the correlation analysis, several variables had a moderate to weak correlation with understanding self-medication. An analysis of multiple ordinal logistic models and backward conditional elimination techniques were used to figure out those determining factors.

The binary logistic regression was employed to examine whether physical activity, medical history, and sociodemographic characteristics helped to explain self-medication to treat menstrual pain in 258 samples. The finding is presented in Table 3. It also describes the coefficients, Wald test values,  $p$ -values, odds ratios, and 95% confidence intervals for odds ratios. When all explanatory variables were treated as continuous variables, such as physical activity, medical history, and sociodemographic characteristics, it was discovered that two of them were statistically significant at the 0.05 level of significance (Table 3). This study aims to evaluate the null hypothesis of the logistic regression model of physical activity, medical history, and



sociodemographic characteristics, as well as to evaluate the alternate hypothesis of the logistic regression model with all explanatory factors using the Likelihood Ratio (LR) test. If  $-2 \log(\Lambda) > \chi_{q,1-\alpha}^2$  or p-value  $< \alpha$ , the null hypothesis is rejected. The LR statistic value in this study was 348,464 and p=0,014 (p<0,050), indicating that physical activity, medical history, and sociodemographic factors included in the model are important. As a result, the model included all explanatory variables. The Wald test was used to compare two hypotheses to determine individual regression slope coefficients (H0:  $\beta_r = 0$  vs H1:  $\beta_r \neq 0$ ) (Astari & Kismiantini, 2019). The Wald values were obtained by dividing the slope coefficients by their standard error (S.E not shown). If the null hypothesis is true, the Wald value for a large sample has an approximate standard normal distribution. Meanwhile, the null hypothesis is rejected if the Wald value is greater than the critical standard normal value or if the p-value is less than the significance threshold. For example, Table 3 shows that the coefficient for a mother's education and family history of dysmenorrhea are 0.045 and 0.005, and the Wald values 4. are 025 and 8.006, respectively. Given the other explanatory factors in the model, the relevant p-value for this test is 0.050. There is substantial evidence that the mother's education and family history of dysmenorrhea is crucial to be included in the model. These findings corroborate with the study conducted by Lee et al. (2017), who argues that there are factors influencing the irrational use of drugs among adolescents, one of which is to overcome menstrual pain. Irrational self-medication can potentially cause adverse drug reactions (ADR) and

worsen health conditions. In 2016, 6,226 adolescents in Taiwan reported that the most frequently reported self-medication drugs included non-steroidal anti-inflammatory drugs or analgesics, with a prevalence rate of 31.1%. Several studies have found that over-the-counter (OTC) use is linked to adverse drug reactions that result in death. These hazards include the use of high doses, prolonged duration of drug use, drug interactions, polypharmacy, drug misuse, and adverse drug reactions (ADR). The most common effect is moderate to chronic gastrointestinal disorders (Lee et al., 2017).

The effect size on the dependent variable is indicated by the exponential value (EXP (B)) or odds ratio (OR). The mother's education had an OR of 0.531, meaning that mothers who do not complete nine years of compulsory education will have a 0.286-times lower risk of self-medication ability level compared to those with higher education (high school, diploma, bachelor's degree). The value of the beta coefficient ( $\beta$ ) was 0.634. This shows a positive relationship between a mother's education and the respondent's ability to self-medicate for primary dysmenorrhea. The higher the mother's educational level, the better the ability of adolescent women to self-medicate. The history of dysmenorrhea had an OR of 2.201, meaning that respondents with a previous history of dysmenorrhea will have a higher level of knowledge or 2.201 times in the ability to self-medicate. The beta coefficient ( $\beta$ ) result was 0.789, meaning the beta coefficient ( $\beta$ ) was positive. The history of dysmenorrhea has a positive relationship with the understanding of self-medication. Based on the coefficient value, the regression equation model was formed as follows:

$$\text{Linear equaton} = \frac{\exp(-0.101 + 0.634 \text{ Mother' s education} + 0.789 \text{ History of dysmenorrhea})}{\exp(-0.101 - 0.634 \text{ Mother' s education} + 0.789 \text{ History of dysmenorrhea})}$$

**Table 3.** Determinant factors of ability primary dysmenorrhea self-medication in logistic regression analysis (multiple ordinal logistcs model) during the COVID-19 pandemic

Predictor factor	Beta coefficient ( $\beta$ )	Wald test	p-value	Odds Ratio (OR)	95%CI	
					Minimum	Maximum
Father's job description	0.125	0.213	0.644	1.133	0.668	1.921
Mother's job description	-0.781	1.001	0.317	1.313	0.770	2.237
Economic impact	-0.185	0.496	0.481	0.831	0.496	1.392
Father's education	0.246	0.837	0.360	1.278	0.755	2.164
Age of respondents	- 0.400	1.998	0.157	0.671	0.385	1.167
Mother's education	0.634	4.025	0.045*	0.531	0.286	0.985
Family history of dysmenorrhea	0.789	8.006	0.005*	2.201	1.274	3.803

\*Significantly partial effect on the level of self-medication ability of menstrual pain with p-value<0.050

According to the linear equation above, if the respondent's mother has a high educational value of '1' and a history of dysmenorrhea of '1', it is predicted that the respondent can provide education by health professionals and parents have a high sensitivity to the lifestyle of teenagers, especially during the COVID-19 pandemic. Stress management is necessary for both physical and mental health. The results of this study can be used as a basis to support and provide education on behavior modification, lifestyle, and the selection of drugs as a means for conducting self-medication wisely and appropriately.

## CONCLUSION

This study's results indicate that most respondents with primary dysmenorrhea experienced moderate until high stress based on the Kessler Psychological Distress Scale (KPDS) questionnaire that was evaluated during the COVID-19 pandemic. The determinant factors that influence stress level are the age of menarche and the length of menstruation in adolescents. The predictors that influence it are the history of dysmenorrhea and the educational level of the mother's educational level. Most respondents have a poor understanding of managing primary dysmenorrhea by self-medicating.

## ACKNOWLEDGMENT

Thanks to all respondents in this study, all parties involved in assisting in the dissemination of the online research questionnaire, and to the Ethics Committee of the Institute for Research and Community Service-LP2M provides research ethics and permits.

## AUTHOR CONTRIBUTIONS

Conceptualization, N.K.; Software, I.N.R.; Methodology, N.K.; Validation, E.D.; Formal Analysis, J.A.H.; Investigation, R.S.O.; Resources, N.K., T.S.; Data Curation, N.K.; Writing - Original Draft, N.K., I.N.R., J.A.H.; Writing - Review & Editing, E.D.; Visualization, E.D.; Supervision, N.K.; Project Administration, V.A.F., R.S.O., T.S., R.N.; Funding Acquisition, N.K., I.N.R., J.A.H.

## CONFLICT OF INTEREST

The authors report no conflict of interest in this study.

## REFERENCES

Al Dhaheri, A. S., Bataineh, M. F., Mohamad, M. N., Ajab, A., Al Marzouqi, A., Jarrar, A. H., Habib-

Mourad, C., Jamous, D. O. A., Ali, H. I., Al Sabbah, H., Hasan, H., Stojanovska, L., Hashim, M., Elhameed, O. A. A., Obaid, R. R. S., ElFeky, S., Saleh, S. T., Osaili, T. M., & Ismail, L. C. (2021). Impact of COVID-19 on mental health and quality of life: Is there any effect? A cross-sectional study of the MENA region. *PLoS ONE*, *16*(March 3), 1–17. <https://doi.org/10.1371/journal.pone.0249107>

Ansong, E., Arhin, S. K., Cai, Y., Xu, X., & Wu, X. (2019). Menstrual characteristics, disorders and associated risk factors among female international students in Zhejiang Province, China: A cross-sectional survey. *BMC Women's Health*, *19*(1), 1–10. <https://doi.org/10.1186/s12905-019-0730-5>

Aolymat, I. (2021). A cross-sectional study of the impact of COVID-19 on domestic violence, menstruation, genital tract health, and contraception use among women in Jordan. *American Journal of Tropical Medicine and Hygiene*, *104*(2), 519–525. <https://doi.org/10.4269/ajtmh.20-1269>

Aolymat, I., Khasawneh, A. I., & Al-Tamimi, M. (2022). COVID-19-Associated Mental Health Impact on Menstrual Function Aspects: Dysmenorrhea and Premenstrual Syndrome, and Genitourinary Tract Health: A Cross-Sectional Study among Jordanian Medical Students. *International Journal of Environmental Research and Public Health*, *19*, 1439. <https://doi.org/doi.org/10.3390/ijerph19031439>

Arafa, A. E., Senosy, S. A., Helmy, H. K., & Mohamed, A. A. (2018). Prevalence and patterns of dysmenorrhea and premenstrual syndrome among Egyptian girls (12–25 years). *Middle East Fertility Society Journal*, *23*(4), 486–490. <https://doi.org/10.1016/j.mefs.2018.01.007>

Armour, M., Parry, K., Al-Dabbas, M. A., Curry, C., Holmes, K., MacMillan, F., Ferfolja, T., & Smith, C. A. (2019). Self-care strategies and sources of knowledge on menstruation in 12,526 young women with dysmenorrhea: A systematic review and meta-analysis. *PLoS ONE*, *14*(7), 1–18. <https://doi.org/10.1371/journal.pone.0220103>

Armour, M., Parry, K., Manohar, N., Holmes, K., Ferfolja, T., Curry, C., Macmillan, F., & Smith, C. A. (2019). The Prevalence and Academic Impact of Dysmenorrhea in 21,573 Young Women: A Systematic Review and Meta-Analysis. *Journal of Women's Health*, *28*(8), 1161–1171. <https://doi.org/10.1089/jwh.2018.7615>

Astari, D. W., & Kismiantini. (2019). Analysis of

- Factors Affecting the Health Insurance Ownership with Binary Logistic Regression Model. *Journal of Physics: Conference Series*, 1320(1). <https://doi.org/10.1088/1742-6596/1320/1/012011>
- Bae, J., Park, S., & Kwon, J. W. (2018). Factors associated with menstrual cycle irregularity and menopause. *BMC Women's Health*, 18(1), 1–11. <https://doi.org/10.1186/s12905-018-0528-x>
- Bennadi, D. (2014). Self-medication: A current challenge. *Journal of Basic and Clinical Pharmacy*, 5(1), 19. <https://doi.org/10.4103/0976-0105.128253>
- Bruinvels, G., Goldsmith, E., Blagrove, R., Martin, D., Shaw, L., Piasecki, J., Ye, Y., Tong, L., Chen, B., Zhao, R., Cao, W., Li, P., Zhang, S. X., Hausner, T., Mittermayr, R., & Schaden, W. (2021). How lifestyle changes within the COVID-19 global pandemic have affected the pattern and symptoms of the menstrual cycle. *MedRxiv*, 1–30. <https://medrxiv.org/cgi/content/short/2021.02.01.21250919>
- Caycho-Rodríguez, T., Tomás, J. M., Vilca, L. W., Carbajal-León, C., Cervigni, M., Gallegos, M., Martino, P., Barés, I., Calandra, M., Anacona, C. A. R., López-Calle, C., Moreta-Herrera, R., Chacón-Andrade, E. R., Lobos-Rivera, M. E., del Carpio, P., Quintero, Y., Robles, E., Lombardo, M. P., Recalde, O. G., ... Videla, C. B. (2021). Socio-Demographic Variables, Fear of COVID-19, Anxiety, and Depression: Prevalence, Relationships and Explanatory Model in the General Population of Seven Latin American Countries. *Frontiers in Psychology*, 12(November), 1–15. <https://doi.org/10.3389/fpsyg.2021.695989>
- Chen, L., Tang, L., Guo, S., Kaminga, A. C., & Xu, H. (2019). Primary dysmenorrhea and self-care strategies among Chinese college girls: A cross-sectional study. *BMJ Open*, 9(9), 1–9. <https://doi.org/10.1136/bmjopen-2018-026813>
- Cohut, M. (2021). *Long COVID and periods: The unspoken impact on female well-being*. <https://www.medicalnewstoday.com/articles/long-covid-and-periods-the-unspoken-impact-on-female-well-being#How-this-has-affected-quality-of-life>
- Critchley, H. O. D., Babayev, E., Bulun, S. E., Clark, S., Garcia-Grau, I., Gregersen, P. K., Kilcoyne, A., Kim, J. Y. J., Lavender, M., Marsh, E. E., Matteson, K. A., Maybin, J. A., Metz, C. N., Moreno, I., Silk, K., Sommer, M., Simon, C., Tariyal, R., Taylor, H. S., ... Griffith, L. G. (2020). Menstruation: science and society. *American Journal of Obstetrics and Gynecology*, 223(5), 624–664. <https://doi.org/10.1016/j.ajog.2020.06.004>
- de Sanctis, V., Soliman, A. T., Daar, S., Di Maio, S., Elalaily, R., Fiscina, B., & Kattamis, C. (2020). Prevalence, attitude, and practice of self-medication among adolescents and the paradigm of dysmenorrhea self-care management in different countries. *Acta Biomedica*, 91(1), 182–192. <https://doi.org/10.23750/abm.v91i1.9242>
- Demir, O., Sal, H., & Comba, C. (2021). Triangle of COVID, anxiety, and menstrual cycle. *Journal of Obstetrics and Gynaecology*, 41(8), 1257–1261. <https://doi.org/10.1080/01443615.2021.1907562>
- Dhawan, A., & Hernole, J. (2020). Effect of Perceived Pandemic Stress and Sleep Variation on Menstrual Cycle Occurrence, its Severity and Premenstrual Syndrome: A Cross-Sectional Study. *Journal of Women's Health and Development*, 03(04), 437–445. <https://doi.org/10.26502/fjwhd.2644-28840052>
- Edelman, A., Boniface, E. R., Benhar, E., Han, L., Matteson, K. A., Favaro, C., Pearson, J. T., & Darney, B. G. (2022). Association Between Menstrual Cycle Length and Coronavirus Disease 2019 (COVID-19) Vaccination. *Obstetrics & Gynecology, Publish Ah(00)*, 1–9. <https://doi.org/10.1097/aog.0000000000004695>
- Esfandiari, L., Nepal, A., Rafi, S. M., & Kannan, G. (2018). Self-medication and role of the pharmacist in patient education. *International Journal of Hospital Pharmacy*, 2–5.
- Ferin, M. (2008). The Hypothalamic Hypophyseal-Ovarian Axis and the Menstrual Cycle. *Global Women's Medicine*. <https://doi.org/10.3843/GLOWM.10283>
- Fitzsimmons, C. (2019). *Teenage girls are more stressed and anxious under lockdown than boys*. <https://www.smh.com.au/lifestyle/life-and-relationships/teenage-girls-more-stressed-and-anxious-under-lockdown-than-boys-20200515-p54tg8.html>
- Grandi, G., Ferrari, S., Xholli, A., Cannoletta, M., Palma, F., Romani, C., Volpe, A., & Cagnacci, A. (2012). Prevalence of menstrual pain in young women: What is dysmenorrhea? *Journal of Pain Research*, 5, 169–174. <https://doi.org/10.2147/JPR.S30602>
- Haeriyah, S., Sar, D. R., Susilowati, Y., & Faridah, I. (2019). Relationship status with nutrition and

- psychological stress on order menstrual cycles for young women. *Nursing & Care Open Access Journal*, 6(5), 180–183. <https://doi.org/10.15406/ncoaj.2019.06.00205>
- Hennegan, J., Shannon, A. K., Rubli, J., Schwab, K. J., & Melendez-Torres, G. J. (2019). Women's and girls' experiences of menstruation in low-and middle-income countries: A systematic review and qualitative meta-synthesis. In *PLoS Medicine* (Vol. 16, Issue 5). <https://doi.org/10.1371/journal.pmed.1002803>
- Jawad, M. J., Abbas, M. M., Jawad, M. J., Hassan, S. M., & Hadi, N. R. (2021). Mental Health and Psychosocial Considerations Post Covid-19 Outbreak. *Wiadomości Lekarskie*, 74(12), 3156–3159. <https://doi.org/10.36740/wlek202112106>
- Lee, C. H., Chang, F. C., Hsu, S. Der, Chi, H. Y., Huang, L. J., & Yeh, M. K. (2017). Inappropriate self-medication among adolescents and its association with lower medication literacy and substance use. *PLoS ONE*, 12(12), 1–14. <https://doi.org/10.1371/journal.pone.0189199>
- Matyas, R. A., Mumford, S. L., Schliep, K. C., Ahrens, K. A., Sjaarda, L. A., Perkins, N. J., Filiberto, A. C., Mattison, D., Zarek, S. M., Wactawski-Wende, J., & Schisterman, E. F. (2015). Effects of over-the-counter analgesic use on reproductive hormones and ovulation in healthy, premenopausal women. *Human Reproduction*, 30(7), 1714–1723. <https://doi.org/10.1093/humrep/dev099>
- McNamara, A., Harris, R., & Minahan, C. (2020). *Menstrual Cycle Change During COVID-19: Sharing some early results*. <https://blogs.bmj.com/bjism/2020/11/20/menstrual-cycle-change-during-covid-19/>
- Mikhael, S., Punjala-Patel, A., & Gavrilova-Jordan, L. (2019). hypothalamic-pituitary axis disorders impacting female fertility. *Biomedicines*, 7(1), 1–9. <https://doi.org/10.3390/biomedicines7010005>
- Miller, V. T. (1988). Diagnosis and initial management of stroke. *Comprehensive Therapy*, 14(7), 57–65. <https://www.aafp.org/afp/2014/0301/afp20140301p341>
- Nareswari, I., Azizah, H. A. F., Murniasih, M., Sinaga, R. D., Novika, R. G. H., & Sari, A. N. (2021). Corelation of Stress Levels During Covid-19 Pandemic and Menstrual Cycle of Diploma IV Midwifery Student of Sebelas Maret University. *PLACENTUM: Jurnal Ilmiah Kesehatan Dan Aplikasinya*, 9(3), 65. <https://doi.org/10.20961/placentum.v9i3.54667>
- Nguyen, B. T., Pang, R. D., Nelson, A. L., Pearson, J. T., Nocchioli, E. B., Reissner, H. R., von Schwarzenfeld, A. K., & Acuna, J. (2021). Detecting variations in ovulation and menstruation during the COVID-19 pandemic, using real-world mobile app data. *PLoS ONE*, 16(October 10 2021), 1–12. <https://doi.org/10.1371/journal.pone.0258314>
- Nugraha, B., Wahyuni, L. K., Laswati, H., Kusumastuti, P., Tulaar, A. B., & Gutenbrunner, C. (2020). COVID-19 pandemic in Indonesia: Situation and challenges of rehabilitation medicine in Indonesia. *Acta Medica Indonesiana*, 52(3), 299–305.
- Oliveira, M. A., Bendo, C. B., Paiva, S. M., Vale, M. P., & Serra-Negra, J. M. (2015). Determining Cut-Off Points for the Dental Fear Survey. *Scientific World Journal*, 2015. <https://doi.org/10.1155/2015/983564>
- Ozimek, N., Velez, K., Anvari, H., Butler, L., Goldman, K. N., & Weitowich, N. C. (2022). Impact of Stress on Menstrual Cyclicity During the Coronavirus Disease 2019 Pandemic: A Survey Study. *Journal of Women's Health*, 31(1), 84–90. <https://doi.org/10.1089/jwh.2021.0158>
- Parra-Fernández, M. L., Onieva-Zafra, M. D., Abreu-Sánchez, A., Ramos-Pichardo, J. D., Iglesias-López, M. T., & Fernández-Martínez, E. (2020). Management of primary dysmenorrhea among university students in the south of Spain and family influence. *International Journal of Environmental Research and Public Health*, 17(15), 1–13. <https://doi.org/10.3390/ijerph17155570>
- Phelan, N., Behan, L. A., & Owens, L. (2021). The Impact of the COVID-19 Pandemic on Women's Reproductive Health. *Frontiers in Endocrinology*, 12(March), 1–8. <https://doi.org/10.3389/fendo.2021.642755>
- Rafique, N., & Al-Sheikh, M. H. (2018). Prevalence of menstrual problems and their association with psychological stress in young female students studying health sciences. *Saudi Medical Journal*, 39(1), 67–73. <https://doi.org/10.15537/smj.2018.1.21438>
- Ravens-Sieberer, U., Kaman, A., Erhart, M., Devine, J., Schlack, R., & Otto, C. (2021). Impact of the COVID-19 pandemic on quality of life and mental health in children and adolescents in Germany. *European Child and Adolescent Psychiatry*. <https://doi.org/10.1007/s00787-021-01726-5>
- Rifati, W., & Sudiarti, T. (2020). A Family History as Dominant Factors Associated with Dysmenorrhea

- Among Adolescents. *Journal of Health and Medical Sciences*, 3(1), 90–97. <https://doi.org/10.31014/aior.1994.03.01.102>
- Rutter, P. (2015). Role of community pharmacists in patients'-ovarian self-care and self-medication. *Integrated Pharmacy Research and Practice*, January, 57. <https://doi.org/10.2147/iprp.s70403>
- Sharp, G. C., Fraser, A., Sawyer, G., Kountourides, G., Easey, K. E., Ford, G., Olszewska, Z., Howe, L. D., Lawlor, D. A., Auvergne, A., & Maybin, J. A. (2021a). The COVID-19 pandemic and the menstrual cycle: research gaps and opportunities. *International Journal of Epidemiology*, 1–10. <https://doi.org/10.1093/ije/dyab239>
- Sharp, G. C., Fraser, A., Sawyer, G., Kountourides, G., Easey, K. E., Ford, G., Olszewska, Z., Howe, L. D., Lawlor, D. A., Auvergne, A., & Maybin, J. A. (2021b). The COVID-19 pandemic and the menstrual cycle: research gaps and opportunities. *International Journal of Epidemiology*, 5, 1–13. <https://doi.org/10.1093/ije/dyab239>
- Singh, R., Sharma, R., & Rajani, H. (2015). Impact of stress on menstrual cycle: A comparison between medical and nonmedical students. *Saudi Journal for Health Sciences*, 4(2), 115. <https://doi.org/10.4103/2278-0521.157886>
- Takmaz, T., Gundogmus, I., Okten, S. B., & Gunduz, A. (2021). The impact of COVID-19-related mental health issues on menstrual cycle characteristics of female healthcare providers. *Journal of Obstetrics and Gynaecology Research*, 47(9), 3241–3249. <https://doi.org/10.1111/jog.14900>
- Thau, L., Gandhi, J., & Sharma, S. (2021). *Physiology, Cortisol*. StatPearls Publishing LLC. <https://www.ncbi.nlm.nih.gov/books/NBK538239/>
- Thibaut, F., & van Wijngaarden-Cremers, P. J. M. (2020). Women's Mental Health in the Time of Covid-19 Pandemic. *Frontiers in Global Women's Health*, 1(December), 1–6. <https://doi.org/10.3389/fgwh.2020.588372>
- Thiyagarajan, D. K., Basit, H., & Rebecca, J. (2020). Physiology, Menstrual Cycle. In *StatPearls Publishing*. <https://www.ncbi.nlm.nih.gov/books/NBK500020/>
- Tran, T. D., Kaligis, F., Wiguna, T., Willenberg, L., Nguyen, H. T. M., Luchters, S., Azzopardi, P., & Fisher, J. (2019). Screening for depressive and anxiety disorders among adolescents in Indonesia: Formal validation of the center for epidemiologic studies depression scale – revised and the Kessler psychological distress scale. *Journal of Affective Disorders*, 246(August 2018), 189–194. <https://doi.org/10.1016/j.jad.2018.12.042>
- United Nations. (2020). Policy Brief: The Impact of Covid-19 on Women. In *United Nations* (Issue April).
- Yamakoshi, B. (2020). Mitigating the impacts of COVID-19 on menstrual health and hygiene. *United Nations International Children's Emergency Fund*, April, 1–8.
- Yamamoto, K., Okazaki, A., Sakamoto, Y., & Funatsu, M. (2009). The relationship between premenstrual symptoms, menstrual pain, irregular menstrual cycles, and psychosocial stress among Japanese college students. *Journal of Physiological Anthropology*, 28(3), 129–136. <https://doi.org/10.2114/jpa2.28.129>
- Yilmaz, S. K., Bohara, A. K., & Thapa, S. (2021). The stressor in the adolescence of menstruation: Coping strategies, emotional stress & impacts on school absences among young womenNepalepal. *International Journal of Environmental Research and Public Health*, 18(17). <https://doi.org/10.3390/ijerph18178894>.