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The Correlation of Animal Protein and Calcium Adequacy Level, Stress Level with Exercise Habits towards Primary Dysmenorrhea Pain in Female Students of SMAN 1 Sukabumi City

Hubungan Tingkat Kecukupan Protein Hewani, Kalsium, Tingkat Stres serta Kebiasaan Olahraga terhadap Derajat Nyeri Dismenorea Primer Siswi SMAN 1 Kota Sukabumi

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ABSTRACT

Background: Primary dysmenorrhea during the menstruation period can cause uncomfortable conditions, reduction in productivity and study concentration, and daily activities in adolescents. Calcium source and animal protein consumption may reduce the pain intensity of primary dysmenorrhea. In addition, normal stress levels and regular exercise habits can regulate the release of hormones that control pain intensity.
Objectives: This study aims to analyze the correlation between animal protein consumption, calcium adequacy level, stress level, exercise habits, and primary dysmenorrhea pain level in female students of SMAN 1 Sukabumi City.
Methods: This quantitative study used an observational study design with a Cross-Sectional approach. Simple random sampling was taken from twelfth-grade science classes with 62 female students in SMAN 1 Sukabumi City. Data collection was performed through interviews using Google Forms and Zoom. The instruments used were SQ-FFQ (Semi-Quantitative Food Frequency Questionnaire), DASS 42 questionnaire (Depression Anxiety Stress Scale), Wong-Baker Pain scale, and exercise habit questionnaire. Bivariate analysis was done using the Chi-Square test with α=0.05.
Results: There was a correlation between the level of calcium adequacy and the scale of primary dysmenorrhea pain in female students of SMAN 1 Sukabumi City (P<0.05), and no significant correlation between the level of adequacy of animal protein consumption, exercise habit, the level of stress and the scale of primary dysmenorrhea pain (P>0.05).
Conclusions: Respondents with sufficient calcium levels can lower the degree of primary dysmenorrhea pain. Therefore, meeting the calcium requirement to prevent menstrual pain is recommended.

INTRODUCTION

Adolescence is a phase between childhood and adulthood. At this time, the maturation of the reproductive organs, or so-called puberty, begins. A woman's puberty, among others, is characterized by menstruation in the form of decay of the uterine wall (endometrium) accompanied by bleeding. This condition occurs repeatedly every month except during pregnancy. The average complaint experienced by women during menstruation is primary dysmenorrhea. Dysmenorrhea is pain caused by cramps in the lower abdomen due to the decay of the uterine wall during menstruation[1].

The two beginning days of a woman's menstruation is the highest concentration of prostaglandin level secreted/released, resulting in severe dysmenorrhea. Primary dysmenorrhea experienced in adolescent girls can be caused by several factors such as the age of first menstruation (menarche) occurred, nutritional status, menstrual cycle, sleep quality, family history, exercise habits, subcutaneous fat, hemoglobin level, and fast food consumption[1–5]. When adolescent girls are experiencing primary dysmenorrhea, physical and excessive activity can further aggravate the condition of dysmenorrhea. Poor calcium intake and stress levels can also affect the condition of a person's primary dysmenorrhea.

The prevalence of primary dysmenorrhea in Indonesia reaches 54.89%, and many adolescents experience 60-75% with mild to severe conditions[6]. A preliminary study conducted by researchers on January

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23th-24th 2020, on all female students of SMAN 1 Sukabumi City through questionnaires about menstrual characteristics and the incidence of primary dysmenorrhea found that 96.1% of the respondents experienced primary dysmenorrhea with a pain level of mild 28.9%, moderate 47.3%, and severe 19.9%. Generally, although there is a relatively high incidence of primary dysmenorrhea, primary dysmenorrhea does not get enough attention. It is considered a natural thing to happen to adolescents who experience menstruation. The treatment carried out by adolescent girls in reducing the intensity of primary dysmenorrhea pain has not been optimal due to a lack of knowledge and counseling related to dysmenorrhea[7]. This causes the condition of dysmenorrhea to become undiagnosed and not treated properly[8]. Primary dysmenorrhea can result in decreased productivity and quality of life for women, absenteeism at school or work, limited physical activity, decreased academic performance and concentration, sleep disorders, mood disorders, anxiety, and depression[9].

The discovery of differences in results in previous studies, the significant prevalence of primary dysmenorrhea in SMAN 1 Sukabumi City, and the researcher's own experience with primary dysmenorrhea make researchers interested in conducting a study on the relationship between the level of adequacy of animal protein and calcium intake, stress levels, exercise habit, and primary dysmenorrhea pain level in SMAN 1 students of Sukabumi City.

METHODS

This study was conducted at SMAN 1 Sukabumi City from March to June 2021. It is quantitative research with a cross-sectional design. The total sample in the study was 60 people, namely grade 12 science students of SMAN 1 Sukabumi City, taken using a simple random sampling technique**.** The inclusion criteria for the study were active female students of SMAN 1 Sukabumi City grade 12 science, aged 16-18, who had experienced menstruation, were physically healthy, and had no history of surgery related to reproductive organs. The criteria for sample exclusion were students who were not willing to be respondents, were not involved in all series of this study to the end, experienced secondary dysmenorrhea, took pain killer before the day of menstruation or before feeling the pain of primary dysmenorrhea, and students who had just experienced menstruation for the first time (menarche) during data collection.

Respondent interviews were conducted online through the Zoom Meeting application due to a face-to-face restriction during the Covid-19 pandemic. The independent variables included adequate animal protein and calcium consumption, stress, and exercise habits. The dependent variable was the degree of primary dysmenorrhea pain. Data on the adequacy level of animal protein and calcium consumption one month before menstruation were obtained using the *SQ-FFQ* (*Semi-Quantitative Food Frequency Questionnaire*) form instrument with additional helping tools, portionimetry, or food photo books so that the researcher and respondents could match. Respondents were given a series of choices on types of food sources of animal protein and calcium they consume, frequency of consumption, processing techniques, and portions in household sizes. Furthermore, the raw weight of all these food ingredients (g/day) was calculated and analyzed using the Indonesian version of the Nutrisurvey application referring to the Indonesian Food Composition Table (TKPI) in 2005 to determine the content of macro and micronutrients so that the total intake of animal protein and calcium of each respondent was obtained.

Data on the animal protein consumption adequacy level was obtained from daily intake divided by the daily animal protein consumption adequacy rate (25% of the daily protein consumption adequacy rate). The level of calcium intake adequacy obtained from a day of calcium intake is divided by the nutritional adequacy rate of calcium intake for adolescent girls aged 16-18, which is 1200 mg. Stress level data was collected using the Indonesian version of the DASS 42 (Depression Anxiety Stress Scale) questionnaire, which has been tested for validity and reliability using Cronbach's alpha formula 0.9483[10]. Question items to measure stress levels are found in questions 1, 6, 8, 12, 14, 18, 22, 27, 29, 32, 33, 35, and 39. The degree of primary dysmenorrhea pain was measured using the standard Wong-Baker Pain Scale questionnaire in Indonesian[11]. Data on exercise habits and menstrual characteristics were gained using questionnaires given online via Google Forms. Before giving their data, respondents were informed through Google Forms in advance about the research procedure and informed consent.

The data collection of this study was carried out by researchers outside school class hours so as not to disturb respondent concentration and was adjusted to respondent free time. The data obtained were presented in the form of category data. The variable of animal protein consumption adequacy level was divided into two categories: inadequate if the level of animal protein consumption was <25% AKP, and adequate if it was ≥25% AKP[12]. The level of calcium intake adequacy was categorized as insufficient if calcium intake was <77% RDA of calcium and sufficient if it was ≥77% RDA of calsium[13]. The stress level was divided into two: normal if the DASS score obtained was 0 to 14 and mild to moderate if the respondent's DASS score was 15-40[10]. Exercise habit was divided into two categories: regular if the exercise was done ≥ 3x per week ≥ 30 minutes per day, and irregular if respondents exercised <3x per week <30 minutes[14]. Analysis of research data was performed using the *Chi-Square* test. This research has passed an ethical review from the research ethics commission of Universitas Esa Unggul with number 0104-21.104 /DPKE-KEP/FINAL-EA/UEU/IV/2021.

RESULTS AND DISCUSSION

Univariate analysis was performed to describe the respondent's characteristics, including age, age of menarche, menstrual cycle, degree and treatment of primary dysmenorrhea, adequacy level of animal protein consumption and calcium intake, stress level, exercise habit, and types of exercise. All variables are presented in the form of category data. The distribution and frequency of each respondent variable are listed in Table 1.

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Table 1. Frequency distribution of characteristics of grade 12 science students at SMAN 1 Sukabumi City with primary dysmenorrhea conditions.

Characteristics of Respondents	Frequency (n)	Percentage (%)
Age of respondents		
17 years old	19	30.6
18 years old	43	69.4
Age of menarche		
11 years old	2	3.2
12 years old	20	32.3
13 years old	27	43.5
14 years old	9	14.5
15 years old	4	6.5
Menstrual cycle		
Polymenorrhea (<21 day)	5	8.1
Normal/normal cycle (21-35 days)	50	80.6
Oligomenorrhea (day 35 day)	7	11.3
Degrees of primary dysmenorrhea		
Mild pain (1-3)	16	25.8
Moderate to severe pain (4-10)	46	74.2
Treatment of primary dysmenorrhea		
Rest/sleep	26	41.9
Warm water compress	20	32.3
Taking pain medication	8	12.9
Leave it alone	8	12.9
Adequacy level of animal protein consumption		
Inadequate (<25% AKP)	12	19.4
Adequate (≥25% AKP)	50	80.6
Adequacy level of calcium intake		
Insufficient (<77 % RDA)	50	80.6
Sufficient (≥77 % RDA)	12	19.4
Stress level		
Normal	29	46.8
Light - heavy	33	53.2
Exercise Habit		
Regular	13	21
Irregular	49	79
Types of exercise		
No exercise	4	6.5
Jogging	16	25.8
Run	2	3.2
Swimming	3	4.8
Cycling	6	9.7
Gymnastics	14	22.6
Zumba	1	1.6
Skipping	8	12.9
Yoga	1	1.6
Workout	4	6.5
Other	3	4.8

AKP (Protein Adequacy Rate), AKG (daily value)

Respondents in this study were chosen from grade 12 science classes because, based on the results of preliminary studies, the prevalence rate of primary dysmenorrhea in grade 12 science was higher than that of other classes, namely with moderate pain category as much as 98.24%. Based on Table 1, most (69.4%) respondents were 18 years old. This age group belongs to the category of late adolescence[15]. Menstruation is a characteristic of female reproductive organs' maturity (discharge of blood and mucus due to unfertilized eggs). Menstrual pain is stronger if a blood clot or lining of the uterine wall (endometrium) decays past the cervix, especially if the cervical canal is narrow[16].

Most respondents (43,5%) experienced their first period by age 13. Menarche age is normal if it occurs between the ages of 12-14[17]. Menstrual age lower than 12 can be one of the factors of the primary dysmenorrhea occurence[18]. This happens because the cervix is still relatively narrow, and the reproductive organs have not developed perfectly, causing pain during menstruation[19].

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Menarche that occurs earlier is driven by nutritional status, heredity, socio-economic, environmental, physical activity, and mass media exposure[20,21].

Based on the menstrual cycle, most respondents (80.6%) belonged to the normal category, 8.1% of respondents had short cycles, and 11.3% had long menstrual cycles. Menstrual cycle is a condition that describes the distance between the first day of menstruation of the previous period and the first day of the current menstruation[22]. Usually, the menstrual cycle is between 21 and 35 days, with a menstrual duration of 3-7 days[17]. There are three types of menstrual disorders, namely polymenorrhea (short menstrual cycle that is less than 21 days), oligomenorrhea (long menstrual cycles which is more than 35 days), and amenorrhoea (not menstruating for three consecutive months)[23].

Based on Table 1, it can be seen that more than half of the respondents (74.2%) experienced a moderate-severe degree of dysmenorrhea pain. Respondents who experienced mild pain were as many as 25.8%. When experiencing primary dysmenorrhea, respondents preferred to rest or sleep (41.9%) and used warm compresses (32.3%). Only eight respondents (12.9%) took pain medication after experiencing primary dysmenorrhea pain on the first day. Treatment for primary dysmenorrhea is generally divided into two categories, namely, pharmacological (consumption of analgesic drugs) and non-pharmacological, such as rest, warm water compresses, and relaxation[24].

The food consumption analysis using the SQ-FFQ method one month before the last menstruation showed that most respondents had adequate animal protein consumption (80.6%). In contrast, only 19.4% of the respondents had inadequate animal protein consumption. Based on the level of calcium intake adequacy, most (80.6%) respondents were in the insufficient category, and those who belonged in the sufficient category were only 19.4%. Adequate intake of nutrients can prevent the risk of pain and discomfort during menstruation[25].

The interview result showed that 53.2% of respondents belonged to the mild-moderate stress category, and 46.8% were categorized into the normal stress category. Adolescents who experience stress undergo a decrease in the body's strength to adjust to pain. This happens because the level of endorphin hormones that function as natural anti-pain substances in the body of somebody who experiences stress is decreased. In addition, when a person is stressed, the production of hormones, including adrenaline, progesterone, estrogen, and prostaglandins, increases. An increase in these hormones can cause excessive contractions in the uterine muscle layer, triggering pain[26].

Data on the frequency distribution of respondents' exercise habits and types of exercise are presented in Table 1. The results found that 79% of respondents did not exercise regularly, while respondents who regularly exercised were only 21%. The types of exercise that were widely done by respondents in this study were aerobic exercise, such as jogging (25.8%), gymnastics (22.6%), and skipping (12.9%). Exercise can benefit health and fitness if done regularly, approximately three times a week. Sports activities carried out 3-5 times every week with a minimum duration of 30 to 60 minutes can reduce the scale of pain and discomfort in the lower abdomen during menstruation[27].

Relationship Between Animal Protein Consumption Adequacy Level and Degree of Primary Dysmenorrhea Pain

The animal protein consumption adequacy level in this study was grouped into two categories based on its contribution to the daily protein adequacy rate. Primary dysmenorrhea is grouped into moderate-severe pain and mild pain. An overview of the relationship between the level of animal protein consumption adequacy and the degree of primary dysmenorrhea pain experienced by respondents is presented in Table 2. Most respondents, both in groups with insufficient or sufficient levels of animal protein consumption, experienced primary dysmenorrhea with moderate-severe pain.

Table 2. The relationship between the level of animal protein consumption adequacy and the degree of primary dysmenorrhea in 12 science students at SMAN 1 Sukabumi City

Adequacy Level of Animal Protein Consumption	Primary Dysmenorrhea				Total		OR (95% CI)	p-value
	Moderate-Severe Pain		Mild Pain					
	n	%	n	%	n	%		
Inadequate (< 25% AKP)	11	17.7	1	1.6	12	19.3	4.714 (0.558 – 39.853)	0.160
Adequate (≥ 25% AKP)	35	56.5	15	24.2	50	80.7		

AKP (Protein Adequacy Rate); OR (Odd Ratio)

The results of the analysis using the Chi-Square test written in Table 2 found that the p-value was 0.160 and the OR value was 4.714, so it can be interpreted that the level of animal protein consumption adequacy was not related to the degree of primary dysmenorrhea pain in respondents of this study. Protein is one of the nutrients that can be obtained from food and drinks. Protein in the body plays an active role in supporting the process of development and growth, the formation of erythrocytes, body resistance, hormones, enzymes, transport devices, muscles, and membrane building[28]. High-protein food usually also contains a lot of fat[29]. Factors that can reduce the nutritional value and digestibility of protein in the body include the Maillard reaction, a reaction with polyphenolic compounds (flavonoids, tannins, dan phenolics), formation of lysinoalanine, and racemization of amino acids[30].

Protein sources found in food are classified into two categories, namely animal protein and vegetable protein. Generally, the quality of animal protein is superior to vegetable protein[12]. Animal protein is easier to digest because it contains essential amino acids that

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are complete, and the arrangement is almost the same as the body's needs so that the amount that can be absorbed is more significant. Vegetable protein is difficult to digest because it is located in cellulose-protected cells. The human digestive system cannot hydrolyze cellulose because it does not have cellulase enzymes, so only a small amount of protein can be absorbed[28]. Sources of animal protein that were widely consumed by respondents in this study were high protein. Most respondents consumed chicken eggs at the average of 4-5 times a week. This is because eggs are easy to get, and the price is affordable and easy to process. 100 g of chicken eggs contain 12.6g of animal protein. The second wide food source of animal protein consumed by respondents was chicken meat. 100 g of chicken meat contains 18.2 g of animal protein. Food sources of animal protein are also related to the essential amino acids contained in them, such as tryptophan and isoleucine, both of which are associated with primary dysmenorrhea.

The amino acid tryptophan can stimulate the release of endorphins and serotonin, activating parts of the brain's analgesia system by inhibiting prostaglandins to reduce the pain of primary dysmenorrhea[31]. Isoleucine is needed by the body to help the formation of hemoglobin and muscle strength[32]. If hemoglobin levels are high in red blood cells, the oxygen carried and circulated throughout the body is also high. Thus, oxygen can be optimally channeled to blood vessels in the reproductive organs that experience vasoconstriction to reduce primary dysmenorrhea[33]. Sources of tryptophan and isoleucine that respondents widely consumed were not the only sources to obtain those two proteins. Those are also sourced in vegetables. The sources of tryptophan and isoleucine that were mostly destroyed by respondents with mild pain levels were chicken eggs, chicken, tofu, and tempeh.

The level of animal protein consumption adequacy of most respondents (80.7%) belonged to the sufficient category. However, improper processing methods were one of the causes of respondents experiencing primary dysmenorrhea of moderate-severe pain intensity. Based on the interview results with respondents, frying was the way to process the source of animal protein that most respondents did. Food menus often consumed with this technique were sunny side up, fried chicken and fish, and nuggets. Frying is a food ingredients processing using oil with a temperature of more than 160˚C. This processing technique can have an impact on significantly reducing nutritional content that can cause protein damage. The higher the temperature and the longer duration of the food processing, the more the protein content and digestibility decrease[34]. Food that contains protein will be damaged if they experience a Maillard reaction. Maillard reaction, often called browning reaction, is a chemical reaction between reducing sugars and amino acids that occurs due to the influence of heat, thus giving a brownish color to food, forming a new aroma and taste[35]. In addition, fat absorption occurs when the frying process carries out the protein source because it fills the empty cavities, replacing the evaporated water content[34]. Consumption of food with high saturated fat content can increase the production of estrogen hormone, which will then stimulate contractions in the uterus so that it can cause pain during menstruation[36].

This study's results align with previous research conducted on IPB students; namely, there was no significant relationship between protein intake and primary dysmenorrhea[37]. Macronutrient intake was not directly related to the incidence of dysmenorrhea but rather to nutritional status[1]. Hence, it can be said that animal protein consumption adequacy was not the only factor that caused primary dysmenorrhea pain in students of 12 Science SMAN 1 Sukabumi City. In this study, other causes most likely associated with the degree of primary dysmenorrhea pain in respondents were hormonal factors, calcium intake, stress, and exercise habits.

Relationship Between Calcium Intake Adequacy Levels and Degree of Primary Dysmenorrhea

This study's level of calcium intake adequacy was grouped into two categories based on the daily calcium intake adequacy figure. The research results on respondents regarding the level of calcium intake adequacy and the degree of primary dysmenorrhea pain are presented in Table 3. Respondents who belonged to the group of insufficient calcium intake adequacy levels tended to experience primary dysmenorrhea in the moderate-severe pain category.

Table 3. The Relationship Between Calcium Intake Adequacy Level and Degree of Primary Dysmenorrhea in Grade 12 Science Students at SMAN 1 Sukabumi City

Calcium Adequacy Level	Primary Dysmenorrhea				Total		OR (95% CI)	p-value
	Moderate-Severe Pain		Mild Pain					
	n	%	n	%	n	%		
Insufficient (< 77 % RDA)	41	66.1	9	14.5	50	80.6	6.378 (1.644 – 24.739)	0.008
Sufficient (≥77 % RDA)	5	8.1	7	11.3	12	19.4		

AKG (daily value); OR (Odd Ratio)

According to the statistical analysis results in Table 3, the relationship between calcium intake adequacy level and degree of primary dysmenorrhea pain had a p-value of 0.008. That is, there was a significant relationship between the level of calcium intake adequacy and the degree of primary dysmenorrhea. Respondents with adequate levels of calcium intake were less prone to experience primary dysmenorrhea pain. The result of the association size analysis (OR) was 6.378 (95% CI: 1.644-24.739), which means that respondents with insufficient calcium intake had a 6.378 greater chance of experiencing moderate-severe primary dysmenorrhea

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pain compared to respondents whose calcium intake adequacy levels were sufficient.

During adolescence, the human body needs micronutrients, including calcium. Calcium needs can be met in food or beverages such as milk, fish, meat, vegetables, and fruit. For teenagers, calcium intake is used for bone growth and to prevent menstrual cramps that can cause primary dysmenorrhea[38]. Nutrients in food that can help calcium absorption are protein, amino acids, vitamin D, magnesium, and lactic acid[39].

Calcium is a mineral that is needed for the process of muscle contraction-relaxation. In addition, calcium also functions in the interaction of proteins in the muscles, namely actin and myosin, when the muscles contract[2]. Calcium helps release norepinephrine, which will attach to uterine beta receptors. When norepinephrine binds to the receptor, it increases cAMP, leading to the activation of protein kinases. Activated protein kinase will phosphorylate an enzyme that releases calcium from the cytoplasm and holds calcium out of the sarcoplasm so that the muscles relax[40]. One of the causes of uterine muscles not relaxing after contractions is a lack of calcium intake; this can cause uterine cramps during menstruation [1] . Calcium can decrease muscle contractions by decreasing neuromuscular excitability[40]. Food sources of calcium include milk and its products (such as yogurt cheese), fish consumed with bones (such as anchovies), cereals, nuts, and its products (tofu, tempeh)[41]. The calcium adequacy rate for women aged 16-18 is 1200 mg / day[13]. The source of calcium widely consumed by respondents with mild pain intensity in this study was cow's milk. The average respondents' consumption of cow's milk was 215 ml, with a frequency of consumption of 3-4 times a day. 100 ml of cow's milk contains as much as 143 mg of calcium. The degree of pain during menstruation can be reduced by adequate calcium consumption[42]. This is in line with research conducted on SMK students in Surakarta related to the relationship between calcium intake and iron intake to dysmenorrhea conditions; it was found that there was a significant relationship between calcium intake and the incidence of dysmenorrhea[38]. Another study on students of SMAN4 Pekalongan found that students who lack calcium consumption will likely experience primary dysmenorrhea 10.6 times greater than students who consume enough calcium[40]. The results of this study are also the same as those in research conducted on nursing students in Malang, which showed that cow's milk consumption had a significant side effect in reducing menstrual pain intensity. Consumption of cow's milk with a content of 1000 mg of calcium given to respondents can lessen the intensity of the menstrual pain scale[43]. However, another study on IVET Semarang students showed different results, that calcium intake was not associated with primary dysmenorrhea[44].

The Relationship Between Stress Level and Degree of Primary Dysmenorrhea

Stress level is classified into two categories, namely mild-severe and normal. The results of the statistical analysis of stress level and degree of primary dysmenorrhea in respondents are presented in Table 4. Most respondents, both in the mild-severe and normal stress groups, experienced primary dysmenorrhea with moderate-severe pain.

Table 4. The Relationship Between Stress Level and Degree of Primary Dysmenorrhea in Grade 12 Science Students at SMAN 1 Sukabumi City

Stress Level	Primary Dysmenorrhea				Total		OR (95% CI)	p-value
	Moderate-Severe Pain		Mild Pain					
	n	%	n	%	n	%		
Light-Heavy	25	40,3	8	12,9	33	53,2	1,190 (0,381- 3,718)	0,993
Normal	21	33,9	8	12,9	29	46,8		

OR (Odd Ratio)

Based on the analysis results in Table 4, there was no significant relationship between the level of stress and the degree of primary dysmenorrhea pain in students of 12 science SMAN 1 Sukabumi City with a p-value of 0.993. Several other factors affect the degree of primary dysmenorrhea pain in respondents in this study, such as hormonal factors, calcium intake, and exercise habits. Thus, stress level was not the main factor that was directly related to the degree of primary dysmenorrhea pain in students of 12 Science SMAN 1 Sukabumi City.

According to Prayitno, the stress level is divided into three parts: mild stress, moderate stress, and severe stress. Causes of mild stress are stressors that occur for a few minutes to several hours. In moderate stress, the presence of stressors lasts more than a week to several years. Severe stress occurs due to the influence of continuous stressors, and there is no certainty of the disappearance of stressors from sufferers that have lasted for years[45]. Academic stress was the most frequent condition experienced by students. This might be caused by the abundant academic demands that must be fulfilled, such as schoolwork, exams, and others[46]. Based on the interview results, some respondents experienced academic stress because they had to study online at home during the Covid-19 pandemic. This led to a lack of concentration and a less optimal understanding of the subject, especially for physics and chemistry subjects.

When a person experiences stress, there is an increase in the production of several hormones in the body, including estrogen, prostaglandins, and adrenaline[46]. Excessive levels of prostaglandins and estrogen can cause extreme contractions in the uterus,

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which can cause primary dysmenorrhea. The increased adrenaline hormone can tense the body's muscles, including the uterus muscles, leading to menstrual pain[47].

Each individual responds to every stimulus differently and alters it into various stress levels due to the differences in how each individual responds to each situation, their ability to control the stimulus, and their life experiences. Stress is influenced by the sensitivity (sensitivity) and tolerance of each individual to the stimulus. Every individual has different excitatory limits to stress in a particular situation. One specific stimulus may cause stress in some conditions but not in different situations[48].

Research on high school students in Kendari illustrated that there was no significant relationship between stress and the incidence of primary dysmenorrhea[49]. The results of this study are also in line with previous research on adolescent girls of SMPN1 Telagasari, Karawang Regency, which found no significant influence between stress and the incidence of primary dysmenorrhea in adolescents[50]. Another study conducted on women of childbearing age in the Ploso Surabaya sub-district is in line with the results of this study that stress level with primary dysmenorrhea had no relation[51]. Another study conducted on adolescent girls in the Bogor district concluded that there was no significant relationship between stress in distance learning and the incidence of menstrual pain. This was because the stress level of female students is mostly in the mild category, with the incidence of primary dysmenorrhea, which was also in the mild category. Moreover, the readiness of female students for distance learning and their ability to adapt caused the level of stress not to have a significant effect on the incidence of dysmenorrhea[52]. Research results on MAN Cimahi City students found that stress levels were unrelated to the incidence of primary dysmenorrhea[53]. Research that has been conducted on adolescent girls in Padang showed that the incidence of primary dysmenorrhea was higher in respondents with mild stress levels. There was a good individual coping ability in dealing with each problem so that the level of stress felt by the individual became lighter and did not affect the incidence of primary dysmenorrhea[54]. Unlike this study, previous research on SMAN4 students in Tangerang City showed a weak relationship between stress levels and primary dysmenorrhea and a positive relationship—the higher the stress, the more painful the primary dysmenorrhea[55]. Additionally, the results of a study of adolescent girls in Bandar Lampung city illustrated that respondents who experienced stress tended to experience primary dysmenorrhea[56]. Another study conducted on female students in Bogor found that the respondent who experienced severe stress was 2.98 times more likely to experience primary dysmenorrhea than those who experienced mild stress levels[57].

Given the difference in results among previous studies, it can be said that stress levels do not directly influence the degree of primary dysmenorrhea pain. There are differences in the time, place, and method of respondents' research data. The main factor that has a significant influence on the intensity of dysmenorrhea pain is the levels of prostaglandin hormones from each respondent during menstruation, which was not investigated directly in this study. According to previous research conducted on adolescent girls in Islamic boarding schools in Makassar, there was a significant difference between prostaglandin levels and pain scales in the group of respondents given vitamin E[58].

The Relationship Between Exercise Habit and The Degree of Primary Dysmenorrhea

Exercise habits were grouped into irregular and regular. The Chi-Square test results on the relationship between exercise habit and the degree of primary dysmenorrhea pain can be seen in Table 5. Respondents who did not exercise regularly tended to experience primary dysmenorrhea with a moderate-severe pain category.

Table 5. The relationship between exercise habit and the degree of primary dysmenorrhea in grade 12 science students at SMAN 1 Sukabumi City.

Exercise Habit	Primary Dysmenorrhea				Total		OR (95% CI)	p-value
	Moderate-Severe Pain		Mild Pain					
	n	%	n	%	n	%		
Irregular	39	62.9	10	16.1	49	79	3.343 (0.917 – 12.180)	0.07
Regular	7	11.3	6	9.7	13	21		

OR (Odd Ratio)

The study results in Table 5 regarding the relationship of exercise habits to primary dysmenorrhea pain in respondents had a p-value of 0.07. In other words, there was no significant relationship between exercise habits and the degree of primary dysmenorrhea pain. Exercise habit is a structured exercise that is carried out regularly. Suitable sports activities are recommended for at least 30 minutes. Three times a week and using appropriate exercise attributes[59]. The human body will produce endorphin hormones when exercising. Endorphin hormones can stimulate serotonin production. Serotonin is a natural pain reliever owned by the human body. Exercise can also facilitate blood circulation and oxygen supply to muscles, including muscles around the reproductive organs that experience vasoconstriction, to reduce the intensity of primary dysmenorrhea pain[17].

Respondents in this study who exercised regularly or did not averagely experienced moderate-severe pain. Regular exercise only slightly affects the intensity of menstrual pain experienced by most respondents[60]. The pain of primary dysmenorrhea still does not disappear despite exercise[61]. Exercise can help reduce menstrual pain by reducing excessive uterine

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muscle contractions[62]. However, muscle relaxation is also influenced by other factors, namely adequate calcium intake. Not exercising regularly was not a factor that directly affected the degree of primary dysmenorrhea pain in respondents in this study. The research results on pre-clinical students of the Faculty of Medicine, Udayana University, align with this study, which found no significant relationship between exercise habits and primary dysmenorrhea[61]. In line with research conducted on SMAN2 Kebumen students, those who exercise regularly experienced primary dysmenorrhea on a moderate pain scale. This shows how respondents' exercise routine does not directly affect the scale of primary dysmenorrhea pain experienced[60].

Research on high school students in West Jakarta showed different results from this study that exercise habits could influence the incidence of menstrual pain. The study also concluded that good exercise habits had a 1.94-fold risk of reducing the incidence of primary dysmenorrhea compared to respondents who did not exercise regularly [63]. Another study conducted on SMAN2 Bangkalan students found that there was a relationship between exercise habits and primary dysmenorrhea; respondents with inactive exercise were 14 times at risk of primary dysmenorrhea[62]. Research conducted on MTS Sukasari students found that exercise habits affect the intensity of primary dysmenorrhea pain. There was a decrease in the scale of dysmenorrhea after exercise intervention[64]. The information on the frequency and intensity of exercise obtained from respondent interviews in this study relied on memory and habits. This might be one of the factors of the different results of this study compared to previous research on the theory. The limitations of this study were that researchers relied on the memory and honesty of respondents regarding animal protein and calcium intake, exercise habits, and stress level experienced by respondents one month before experiencing the last menstruation. Moreover, the interviews were conducted online, relying on the internet network's stability. We had several obstacles in terms of internet stability, both from the researcher's and the respondents ' sides. Those obstacles affected the effectiveness of the duration of data collection.

CONCLUSIONS

This study significantly showed that adequate calcium intake was associated with the degree of primary dysmenorrhea pain. Meanwhile, the level of animal protein consumption adequacy, stress level, and exercise habits did not significantly relate to the degree of primary dysmenorrhea in SMAN 1 Sukabumi City students**.** It is recommended for students of SMAN 1 Sukabumi City to check with health workers (doctors or midwives) if they feel signs of severe primary dysmenorrhea symptoms to get appropriate handling therapy so respondents can perform their activities and productivity normally. To reduce the pain of primary dysmenorrhea, respondents can consume balanced nutritious food, especially calcium sources such as cow's milk, cheese, and other sources of calcium, as well as food containing essential amino acids such as eggs, meat, and others. For further research, paying attention to other factors associated with primary dysmenorrhea is necessary. If it is needed to measure the food intake of respondents, it is better to use the food weighing method so that the results obtained are more optimal. It's necessary to pay attention to the inhibiting factors of nutrient absorption. It is also suggested that schools, especially the School's Health Unit, hold counseling activities related to primary dysmenorrhea and how to prevent and overcome it.

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