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Calcium and Iron Intake, and Sport Habit as A Determinant of Dysminorrhea on Adolescents

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ABSTRACT

Background: Pain during menstruation or dysmenorrhea is described as pain in the lower abdomen, back, and a feeling of bloating. It causes pain and inconveniece during menstruation. Inadequate nutrient intake or dietary habits become one of the factors that affect this condition. This study aims to investigate calcium and iron intake as well as sports habits as determinants of dysmenorrhea. **Methods:** The population in this study included 396 female adolescents in Tuban District, they were who experienced dysmenorrhea. The sample was selected using a cluster random sampling technique of 199 respondents who met the inclusion criteria, including female adolescents aged 16-18. The Spearman correlation test was used for analysis in this study. **Results:** The regression analysis revelaed that iron intake was significantly associated with dysmenorrhea scores (β=0.845; 95% CI: 0.760–0.931; *P*<0.001), while calcium intake (β=0.009; 95% CI: –0.132–0.149; *P*=0.900) and sport habits (β=–0.161; 95% CI: –0.399–0.077; *P*=0.183) were not significantly associated. **Conclusion:** There was a significant correlation between iron intake and the incidence of dysmenorrhea. Meanwhile, calcium and sports habits had a weak correlation.

Background

Menstruation is one of the indicators of reproductive health in women and is a physiological process. However, adolescent girls often experience disorders during menstruation, one of which is dysmenorrhea (Alsaleem, 2018, Cai *et al.*, 2025, Parker *et al.*, 2010). Pain during menstruation or dysmenorrhea is the most common disorder that occurs in adolescents during menstruation, which is described as pain in the lower abdomen, back, and a feeling of bloating (Agarwal and Agarwal, 2010).

The prevalence of dysmenorrhea in adolescents is quite high (50-80%) (Adeyemi and Adekanle, 2007, Karout *et al.*, 2021, Parker *et al.*, 2010). In addition, other studies also state that dysmenorrhea occurs in 45-97% of cases in

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different age and racial groups (Kim *et al.*, 2017, Lee *et al.*, 2016). Dysmenorrhea is thought to occur due to increased prostaglandins and leukotrienes in the myometrium. Furthermore, fatty acids are produced at the end of the ovulation stage and are accumulated in the cell membrane. At the end of the cycle, there is a decrease in progesterone levels which results in the release of these fatty acids as precursors of prostaglandins and leukotrienes (Azagew *et al.*, 2020).

Dysmenorrhea in adolescents can lead to absenteeism from school, sleep disturbances, fatigue, self-isolation, sexual dysfunction, infertility, anxiety, and even depression. These issues generally affect the quality of life, such as mental and physical health conditions, social relationships, education and career (Amza *et al.*, 2024, MacGregor *et al.*, 2023). Another study reported that adolescents girls (on secondary school) with dysmenorrhea were absent from school and also affected some other activity such as class concentration, class participation, social and sport activities (Femi-Agboola *et al.*, 2017). Dysmenorrhea also has a significant negative impact on academic performance both at school and higher education (Armour *et al.*, 2019).

Many things have been studied to reduce the incidence of dysmenorrhea and the causes of dysmenorrhea, some of which are related to nutrient intake, because nutrients will affect hormonal changes in the body (Naz *et al.*, 2020).

The increased consumption of fruit and vegetables, and also fish and milk have a positive impact on reducing the pain during menstruation because both of them are the sources of vitamins and mineral (Bajalan *et al.*, 2019). The nutrients that is thought to have an important role in reducing dysmenorrhea symptoms are calcium (Zarei *et al.*, 2017) and iron which determines Hb levels in the blood (Hou *et al.*, 2024). The findings from some studies reported that calcium combined with vitamin D could effectively reduce the severity of primary dysmenorrhea and the reliance on analgesic (Abdi *et al.*, 2021, Donayeva *et al.*, 2023, Zarei *et al.*, 2017). Another thing that can suppress the production of prostaglandins and dysmenorrhea is sport habit. This is because while doing exercise the body will produce endorphin hormones (Köseoglu *et al.*, 2003) which can inhibit the release of prostaglandin hormones.

Many people think that menstrual pain is a very normal thing and can happen to women who menstruate; but, some women experience prolonged pain that cannot do activities during menstruation because the pain is unbearable. Based on the background description above, the authors are interested in conducting further research on the correlation between calcium and iron intake and sport habits and the incidence of dysmenorrhea in adolescent girls.

Materials and Methods

Respondents

The population in this study were all female adolescents in SMA Negeri 2 and 4 in Tuban District totaling 396 female adolescents who experienced dysmenorrhea. The sample was selected using cluster random sampling technique of 199 respondents who met the inclusion criteria including female adolescents aged 16-18 year in grades 10 and 11; they had experienced menarche and were not sick.

Research instruments

An instrument is a measuring tool created by a researcher according to the research objectives in order to measure what should be measured and can provide a description of the differences in research subjects. The research instrument used in this study was the semiquantitative food frequency questionnaire (SQ-FFQ) to measure calcium and iron intake variables. Based on some articles, the elements most frequently mentioned in this instrument were macronutrientsand some micronutrients such as calcium and also iron (Sierra-Ruelas *et al.*, 2021). Calcium intake‘s data was collected through direct interviews with respondents to explore more detailed information about respondent‘s food consumption during the last

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month and asked about household measures (HHM). The SQ-FFQ contains a list of MMH or number of portions so that, in addition to obtaining the type and frequency of food, the amount usually consumed is also asked. The steps taken in filling out the questionnaire determined the survey period (1 month before), recorded the types of food and drinks consumed during a specified time period, asked about the frequency of consumption of marked foods and drinks along with portions to obtain data on the frequency of consumption regarding a number of foods during a certain period (day, week, month, year), converted all categories in a day, multiplied the weight (grams) of each food ingredient by the frequency, and calculated nutritional value. The data collected on calcium and iron intake through the SQ-FFQ were summarized using the Nutri Survey application, and the results were classified into several intake categories based on the guidelines of Ministry of Health of the Republic of Indonesia, which categorized intake levels as follow; <70% of the recommended dietary allowance (RDA) was defined as severe deficit, 70-89% as moderate deficit, 90-120% as normal (adequate intake), and >120% as excess (Kementerian Kesehatan Republik, 2013).

The next instrument was used to collect sports habits data by questionnaire. The authors compiled a questionnaire based on several sources (Higgins and Higgins, 2016, Hootman, 2009) and tested for validity and reliability. Validity test was done using *SPSS for Windows* on 30 respondents to obtain a distribution of measurement values approaching normal values (Kuantitatif, 2016). Meanwhile, the reliability test of this research instrument used the Cronbach Alpha technique which was also obtained from the calculation results using SPSS for Windows. After all, the questions in the questionnaire were selected based on the validity and reliability test provisions, and the respondent's sport habits were classified into two categories. Participants were categorized in regular group if they engaged in exercise at least three times per week with duration of ≥30 minutes per session. Meanwhile, participants were categorized into irregular group if they engaged in excercise fewer than three times per week with a duration <30 minutes per session.

The instrument used to collect dysmenorrhea data was the dysmenorrhea incident form using *the* Numeric Rating Scale (NRS) form which is this form can be considered a valid and reliable patient-reported outcome measure for assessing dysmenorrhea-related pain intensity (Barbosa-Silva *et al.*, 2024, De Arruda *et al.*, 2022). Participants chose the number of scale of NRS form to describe the level of pain felt. Finally, the results of filling out the questionnaire are classified as follows; pain scale 0: no pain, pain scale 1-2: mild pain, pain scale 3-6: moderate pain, pain scale 7-9: controlled severe pain, and pain scale 10: severe uncontrolled pain.

Ethical considerations

The form of agreement between the researcher and the respondents in this study includes providing an informed consent form given to all respondents. If the respondent is willing to participate in the study, the he/she must sign the consent form, and if the respondent is not willing to participate in the study, the researcher does not force and still respects the respondent's decision. The name of the respondent on the informed consent form only needs to include a code to maintain confidentiality.

Data analysis

The data collected in this study were analyzed by Spearman Rank Correlation test using SPSS for Windows, version 25. Spearman rank correlation was used to find the level of correlation or test the significance of the associative hypothesis assuming that each variable is connected and the data scale is ordinal. The purpose of this method is to obtain the best and simplest model that can describe the correlation between independent variables and dependent variables; there was a correlation between calcium and iron intake and sport habits and the incidence of dysmenorrhea in female

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adolescents with P-value<0.05 sets as a significant point. Regression analysis in this study was used to examine the most significant factor and how it affects the dysmenorrhea.

Results

Respondents in the study amounted to 199 people with 48% of respondents aged 17, 34% aged 16, and 18% aged 18 years. In addition, 53% were in the grade 11 category and 47% in grade 10. The average daily calcium intake of respondents was 706.40 mg and iron intake was 11.27 mg.

The distribution of respondents' data based on calcium and iron intake is shown in **Table 1.** The table shows that most respondents (67%), experienced a severe deficit in calcium intake, namely an average daily consumption of less than 70%, and in the second place, were respondents who experienced a moderate deficit, amounting to 22%. A moderate deficit has an average daily calcium intake of between 70-80%. In addition, almost half of the respondents also experienced a severe deficit in iron intake, namely 41%. Based on the results, as many as 89% of the respondents did not exercise regularly, and conversely, only 11% did exercise regularly. Based on **Table 2,** none of the respondents experienced dysmenorrhea during menstruation, with varying degrees of pain, and most of them experienced dysmenorrhea with moderate pain levels, namely 38%.

Table 3 shows that almost half of the respondents with severe deficit in calcium intake, experienced menstrual pain on a moderate scale consisting of 46%, Most of the respondents with moderate calcium intake deficit experienced pain on a mild scale, namely 58.1%. 81.3% of the respondents with normal calcium intake still experienced dysmenorrhea but on a mild scale. 86% also had excess calcium intake and still experienced dysmenorrhea on a mild scale. Based on statistical tests using the Spearman correlation test on calcium intake with the incidence of dysmenorrhea, a P<0.001 was obtained, and therefore, P<0.05 with a Correlation Coefficient value of 0.436. This shows that there is a fairly strong correlation between calcium intake and the incidence of dysmenorrhea.

Based on **Table 3**, 42% of respondents with severe iron deficiency experienced dysmenorrhea with moderate pain intensity. 38% of the respondents with moderate deficit iron intake also experienced dysmenorrhea with moderate pain intensity. Meanwhile, participants with normal and excess iron intake mostly experienced dysmenorrhea with mild pain intensity, 58% and 60.0 % respectively. Based on statistical tests using the Spearman correlation test on iron intake with the incidence of dysmenorrhea, a P<0.001 was obtained, and therefore, P<0.05 with a Correlation Coefficient value of 0.356. This shows that there is a fairly strong correlation between iron intake and the incidence of dysmenorrhea.

Table 3 shows that most of the respondents with a percentage of 39.9 % who did not exercise regularly, experienced dysmenorrhea with moderate intensity. While 66% who exercise regularly, experienced dysmenorrhea with mild pain intensity. Statistical tests using the Spearman correlation test on sport habit with the incidence of dysmenorrhea show a P=0.002, so that P<0.05 with a Correlation Coefficient value of 0.217. This shows that there is a correlation between sports habits and the incidence of dysmenorrhea, but the correlation between the two is considered very weak.

Table 4 shows the result of multiple linear regression analysis. It was performed to examine the influence of calcium levels, iron levels and sports habits on dysmenorrhea. The analysis revealed iron was the most significant factor that affected the dysmenorrhea with Standardized coefficient value β=0.963 (P<0.001) compared to calcium (β=0.009; P=0.900) and sport habits (β=-0.063; P=0.183). then unstandardized coefficient value β=0.845 on iron indicated that every increase of 1 unit of iron level would increase the dysmenorrhea score by 0.845, assuming the other variables remain constant.

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Table 1. Frequency distribution of calcium and iron intake.

Variable	n	%
Calcium		
Severe deficit[a]	133	67
Moderate deficit[b]	43	22
Normal[c]	16	8
Excess[d]	7	3
Iron		
Severe deficit	81	41
Moderate deficit	62	31
Normal	46	23
Excess	10	5

[a]: <70% of RDA; [b]: 70-89% of RDA; [c]: 90-120% of RDA; [d]: >120% of RDA.

Table 2. Frequency distribution of dysmenorrhea occurrence.

Pain intensity scale	n	%
No pain	0	0
Mild pain	70	35
Moderate pain	76	38
Severe controlled pain	51	26
Severe uncontrolled pain	2	1

Discussion

This cross-sectional study discusses the correlation between calcium, iron intake, and sport habits and the incidence of dysmenorrhea in adolescent female. Dysmenorrhea is a common complaint experienced by adolescents during menstruation, which can affect health and quality of life (Firouzi *et al.*, 2019). Dysmenorrhea is described as colicky pain in the suprapubic area before or during menstruation which is usually very painful on the first or second day of menstruation (Dawood, 2006, Osayande and Mehulic, 2014). Other complaints that are usually felt when experiencing dysmenorrhea are nausea or vomiting, diarrhea, lower back pain, migraine, dizziness, fatigue, insomnia, and even hyperthermia (Doty and Attaran, 2006). These things are thought to be due to the release of prostaglandins in menstrual blood and cause uterine contractions and pain. Pain is also caused by increased levels of the hormone vasopressin which can also increase uterine contractions and cause ischemic pain (French, 2005). Dysmenorrhea and its accompanying conditions are known to reduce the quality of life of an adolescent, such as reducing the level of attendance and concentration in class, reducing the quality of social activities and sports activities, causing a bad mood, and even causing poor quality sleep (Femi-Agboola *et al.*, 2017, Iacovides *et al.*, 2015).

Considering the significant impact of dysmenorrhea on the health of adolescent girls, much research has been conducted to determine the correlation between factors related to the occurrence of dysmenorrhea. Previous studies have shown that optimal nutrient intake can reduce the risk of dysmenorrhea, such as Vitamins K, D, B1 and E, calcium, magnesium, zinc and boron. Most of these vitamins and minerals provide anti-inflammatory and anti-pain effects to overcome dysmenorrhea pain (Naz *et al.*, 2020). Other studies also suggest that vitamins can be used as pain management in dysmenorrhea (Matsas *et al.*, 2023). Based on the results of the SQ-FFQ conducted through interviews with respondents, the adequacy of respondents' intake is determined by comparing real intake with the RDA. Most of the respondent's calcium intake is included in the severe deficit category. Most young women rarely consume a variety of foods, plus uncontrolled diet behavior by limiting food intake so that the nutrients consumed are not sufficient. Furthermore, there were respondents who never consumed milk even though milk contains high calcium; assuming that consuming milk causes obesity, the respondents avoid it. Another factor that causes a lack of calcium intake in respondents is that they reduce the portion and frequency of eating so that the nutrients consumed are not sufficient. After collecting data, it turned out that respondents had never consumed calcium supplements. Sources of calcium often consumed are fish, tofu, spinach, oranges and also 1 glass of milk every day. Only a few participants (namely 7 (3%)), have more calcium intake; this is because respondents usually consume milk more than 1 time a day so that calcium intake exceeds the RDA of calcium per day. The average calcium intake was 706.40 mg

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/day; this figure is not sufficient for the daily calcium requirement according to the RDA, which is 1,200 mg/day. In this study, it was found that there is a fairly strong correlation between calcium intake and the incidence of dysmenorrhea in adolescent girls. Calcium is a mineral that is very much needed by teenagers; it is not only needed for bone growth, but also for reducing pain before or during menstruation, which is commonly called dysmenorrhea. Calcium plays a role in relaxing muscles, including the muscles of the reproductive organs. If there is a calcium deficiency, the muscles cannot relax after contraction, which can result in muscle cramps (Thys-Jacobs *et al*., 2007).

More than 70% of calcium in the diet is provided by dairy products (Canabady-Rochelle *et al*., 2007), so adolescents can consider dairy foods or drinks as an alternative to reduce dysmenorrhea pain. In addition to dairy products, adolescents can also choose other sources of calcium from foods that contain high amounts of calcium, such as fish and moringa leaves. Even in a study examining the difference in the combination of calcium-magnesium and calcium in reducing the intensity of dysmenorrhea pain, only calcium showed an effect on reducing the intensity of dysmenorrhea pain. Beside food intake, dysmenorrhea management using calcium can also be done through supplementation. The intensity of dysmenorrhea pain is significantly reduced by giving calcium supplements of 1000 mg per day from the 15th day of the menstrual cycle until the symptoms of dysmenorrhea disappear in the next cycle (Zarei *et al.*, 2017). Respondents with sufficient calcium intake while experiencing dysmenorrhea and other related factors of dysmenorrhea lacked physical exercise, had poor sleep quality, skipped breakfast, were underweight, and had caffeine consumption, and short sleep duration (Donayeva *et al.*, 2023, Wang *et al.*, 2022).

Based on the results of the SQ-FFQ that have been conducted through interviews with respondents, and comparing them with the RDA, most of the respondent's iron intake belonged to the severe deficit category. This is due to the low frequency of consumption of foods high in iron; adolescent females also never consume iron supplementation even though they are susceptible to iron deficiency anemia because they menstruate every month. Iron is the main component that plays an important role in blood formation, namely synthesizing hemoglobin. One of the functions of hemoglobin is to bind oxygen which will be circulated throughout the body. The oxygen that is bound and circulated throughout the body is only a little if the hemoglobin level is low; low amount of oxygen is then not distributed to the blood vessels optimally, one of which is the reproductive organs which during menstruation will cause pain (Maula *et al.*, 2017).

The need for iron for teenage girls is very important because iron is one of the elements in the process of forming red blood cells. Low iron intake in the body causes anemia, especially in teenage girls who experience menstruation every month and lose a lot of iron. During growth, adolescent girls experience an increase in blood volume and body tissue so that they need a lot of iron for hemoglobin (Hb) synthesis (Low *et al.*, 2016). Previous studies have found that low hemoglobin levels are one of the factors that influence the occurrence of dysmenorrhea (Henríquez-Hernández *et al.*, 2017). Hb functions to bind O_2 and distribute it to all body tissues, so if Hb is insufficient, body tissues and organs lack O_2 and cause hypoxia and trigger the release of prostaglandins that cause uterine vasoconstriction (Meng *et al.*, 2019) as a cause of dysmenorrhea pain (Lebso *et al.*, 2017). Hb synthesis in the body is assisted by iron. More than two-thirds of iron is found in Hb (Andrews, 1999).

The results of the interpretation data obtained from the study on 199 respondents showed that there was a significant correlation between sport habits and dysmenorrhea in respondents. This study was in line with previous research conducted by (Samy *et al.*, 2019, Tharani *et al.*, 2018) which showed that aerobic dance and Zumba exercise in young women can reduce the incidence of dysmenorrhea and symptoms of primary dysmenorrhea. Respondents with irregular sport

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habits experienced moderate pain with a percentage of 39.9 %. Another study showed that menstrual pain was significantly ameliorated on implementation of physical activity such as spinning bike exercise. Thus, this may occur through the modulation of prostaglandin and decreased inflammation during menstruation (Huang *et al.*, 2022).

Table 3. Correlation between calcium and iron intake, sport habits and the incidence of pain intensity scale.

Variable	Pain intensity scale										Total
	No pain		Mild pain		Moderate pain		Severe controlled pain		Severe uncontrolled pain		
	n	%	n	%	n	%	n	%	n	%	
Calcium											
Severe deficit	0	0.0	26	19.5	62	46.6	44	33.1	1	0.8	133
Moderate deficit	0	0.0	25	58.1	11	25.6	6	14.0	1	2,3	43
Normal	0	0,0	13	81,3	2	12,5	1	6,3	0	0,0	16
Excess	0	0,0	6	85,7	1	14,3	0	0,0	0	0,0	7
Iron											
Severe deficit	0	0.0	16	19.8	34	42.0	29	35.8	2	2.5	81
Moderate deficit	0	0.0	21	33.9	24	38.7	17	27.4	0	0.0	62
Normal	0	0,0	27	58,7	14	30,4	5	10,9	0	0,0	46
Excess	0	0,0	6	60,0	4	40,0	0	0,0	0	0,0	10
Sport habits											
Irregular	0	0.0	56	31.5	71	39.9	49	27.5	2	1.1	178
Regular	0	0.0	14	66.7	5	23.8	2	9.5	0	0.0	21
Total	0	0.0	70	35.2	76	38.2	51	25.6	2	1.0	199

Table 4. Multiple linear regression analysis.

independent variable	Beta (unstd coeff.)	Std. error	Beta (standard)	t	P-value	95% CI for B
Constant	1.463	0.095	–	15.371	0.000	1.276 – 1.651
Calcium	0.009	0.071	0.009	0.125	0.900	–0.132 – 0.149
Iron	0.845	0.044	0.963	19.420	0.000	0.760 – 0.931
Sport habits	–0.161	0.121	–0.063	–1.338	0.183	–0.399 – 0.077

Exercising can contribute to around 20-50% of energy expenditure (Maslakhah and Prameswari, 2022). Burning or increasing metabolism occurs in the body of every person who does exercise, which also helps the body to heat up and sweat. Women who rarely exercise are at greater risk of experiencing dysmenorrhea than women who exercise regularly. For example, aerobic exercise has been shown to stimulate the release of endorphin hormon. The high endorphins level will act as the analgesic for non-spesific pain (Colt *et al.*, 1982).

The finding of this research about irregular sport habits are caused by the majority of respondents only exercising at school. Even though exercise has an important role in the occurrence of dysmenorrhea, respondents said they were lazy to exercise outside of school because of the busy school activities and not being able to manage time to exercise.

The results of this study were in line with the data from WHO. Globaly, physical inactivity and the sedentary lifestyle occur in almost 30% of adults and more than 80% of school age adolescents. The most physically inactive population are in developed countries (Guthold *et al.*, 2020, Katzmarzyk *et al.*, 2022, Wachira *et al.*, 2022).

There are several reasons why someone does not exercise regularly, such as lack of time and

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motivation, lack of social support, economic difficulties,and physical discomfort (Baillot *et al.*, 2021, Fathi *et al.*, 2021, Guthold *et al.*, 2020, Murillo *et al.*, 2021). Time is a major factor, especially among busy people. Cost is also often used as an excuse because of the assumption that serious sports require expensive equipment. This is what causes someone to be reluctant to exercise regularly. Exercise will help the body to distribute the oxygen throughout the body through the bloodstream. If exercise is not done regularly, the body will lack oxygen (Piercy *et al.*, 2018). During menstruation or the menstrual cycle, physiologically, women will feel discomfort or pain. , and the body will produce a chemical substance called prostaglandin. Prostaglandin is a compound that regulates uterine activity. If prostaglandin levels are excessive, uterine contractions during menstruation increase, resulting in severe pain, and pain will increase if women experience stress, lack of exercise and unbalanced nutritional intake.

Based on the facts and theories obtained, researchers argue that female adolescents with irregular sport habits experience moderate to severe pain due to a lack of awareness of the importance of regular exercise. Respondents with regular sport habits experience mild pain because in addition to doing sports at school, they also do other sports outside of school.

Regression analysis in this study showed that iron intake is the most significant factor on dysmenorrhea. This finding aligned with another study that reported poorer nutritional status (including iron deficiency) was associated with increased severity of menstrual pain (Yuna *et al.*, 2023), even the finding from another study reported that dysmenorrhea genetically influenced and was associated with iron deficiency (Talebpour *et al.*, 2023). A study conducted on rats with an iron-deficient diet showed there was an increase of pain threshold and chronic pain responses and also increase of celluler proto-oncogen FOS (c-FOS) expression in the spinal cord (Dowling *et al.*, 2009); this indicates the involvement of the central nervous system in pain sensitivity. Iron, together with O_2 and tetrahydrobiopterin (BH4), supports the synthesis of serotonin and dopamine for neurotransmitter regulation. Serotonin plays a role in regulating mood and feelings of happiness, as well as maintaining stable emotional conditions, while dopamine is the main neurotransmitter involved in motivation, reward, and reinforcement. The synthesis of both will be disrupted in the event of iron deficiency, leading to decreased feelings of happiness and emotional stability (Berthou *et al.*, 2021); this condition is thought to worsen the perception of dysmenorrhea pain.

The results of the statistical test using regression in this study showed that calcium intake did not have a significant association with dysmenorrhea. This may occur because several studies have reported that calcium absorption in the body depends on vitamin D (Amzajerdi *et al.*, 2023, Barbosa-Silva *et al.*, 2024). Calcium helps regulate uterine muscle contraction and relaxation, thereby minimizing menstrual pain. However, calcium absorption also depends on a person's vitamin D status, since vitamin D not only reduces prostaglandins but also enhances calcium absorption itself. (Amzajerdi *et al.*, 2023, Barbosa-Silva *et al.*, 2024). The absence of a significant association between sport habits and dysmenorrhea may be due to the fact that the type of exercise examined in this study was not specific to a particular form of physical activity. The types of exercise reported as effective in reducing menstrual pain are aerobic exercise, relaxation, and pilates, with training arranged in terms of duration and frequency on a regular basis (Cai *et al.*, 2025). The increase in prostaglandin (PGF2α) levels, which causes pain during menstruation, cannot always be reduced by exercise only, as other lifestyle factors may have a greater influence on menstrual pain, such as stress, sleep duration, and sleep timing (Mitsuhashi *et al.*, 2022). The research analyzing the relationship between body mass index (BMI) and the incidence of dysmenorrhea has shown a high significance; however, when further investigations were conducted on other factors, including sport activity, it did not emerge as a strong predictor

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compared to BMI (Takata *et al.*, 2023, Wu *et al.*, 2022). Nevertheless, there are findings from other studies that have identified a relationship between exercise and the occurrence of dysmenorrhea. This may be because those studies analyzed specific and uniform types of exercise and were conducted specifically on the same group(female athletes) (Momma *et al.*, 2021, Tsai *et al.*, 2024).

This study had several limitations that should be acknowledged. The sample size was relatively small, it may restrict the generalizability of the findings to a bigger population. Then, the assesment of calcium and iron intake by SQ-FFQ which highly depends on the participant's memory of their one month consumption. Sport habits also were not measured on specific sport activity and it may introduce bias on the sport habits data. Furthermore, the cross-sectional design limits the ability to establish causal relationships between calcium and iron intake, sport habits, and dysmenorrhea. Potential confounding factors such as nutritional status, sleep quality, and stress levels were not accounted for, which might also influence dysmenorrhea. Future studies should involve larger and more diverse samples, apply more accurate dietary and sport habits assessments, and consider longitudinal designs to better clarify the causal role of nutrient intake and lifestyle factors in dysmenorrhea.

Conclusion

This study concludes that there is a significant association between iron intake and dysmenorrhea, while calcium intake and sport habits were not significantly related. These findings highlight the important role of adequate iron intake in reducing the risk and severity of dysmenorrhea among adolescent girls. Nutrition education should emphasize the important of consuming iron-rich foods from both animal and plant sources with absorbtion enhancers like vitamin C. Schools, healthcare providers, and government and also families have a crucial role in supporting a balanced diet and early iron status screening to prevent health problems regarding adolescents. Ultimately, longitudinal or interventional designs are recommended, such as clinical trials involving iron supplementation or food fortification, to evaluate the effectiveness of improving iron status in reducing menstrual pain.

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Authors' contribution

All of the authors contributed to all parts of the article. Also, they all read and agreed on all aspects of this study.

Conflict of interest

The authors declared no conflict of interest.

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