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The Relationship Between Zinc and Calcium Intake and Primary Dysmenorrhea in Adolescent Girls at SMA Negeri 1 Rantau Seselan

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ABSTRACT

Painful cramps in the lower abdomen characterize primary dysmenorrhea. The cramps or pain you feel can be reduced by consuming adequate zinc and calcium. This study aimed to determine the relationship between zinc and calcium intake and primary dysmenorrhea in adolescent girls at SMA Negeri 1 Rantau Selatan. This research was conducted in July 2024 at SMA Negeri 1 Rantau Selatan. The design of this research was cross-sectional; the study sample consisted of 44 participants selected through purposive sampling. The data collection technique involves completing the Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) and Numerical Rating Scale (NRS) independently, under the supervision and direction of researchers. The results of this study showed that the majority of respondents had insufficient zinc intake (63.6%) and sufficient calcium intake (65.9%), and 50% experienced primary dysmenorrhea. Data analysis was conducted using the chi-square test and logistic regression analysis. Based on the analysis results, a significant relationship ($p < 0.05$) was found between zinc and calcium intake and primary dysmenorrhea. Meanwhile, young women who consume less calcium have a 14,566 times higher risk of experiencing dysmenorrhea, while those who consume less zinc have a risk of experiencing dysmenorrhea 11,790 times. A sufficient intake of zinc and calcium can help reduce primary dysmenorrhea by regulating uterine muscle contractions.

Keywords: primary dysmenorrhea, calcium, young women, zinc

INTRODUCTION

Menstruation in adolescents is a regular event, although many adolescents experience menstrual disorders, such as complaints of pain during menstruation (dysmenorrhea). Painful cramps in the lower abdomen characterize primary dysmenorrhea. Cramps are caused by very intense contractions of the uterine muscles, which are intended to release layers of the uterine wall that are no longer needed. (Sinaga et al., 2017).

According to the WHO (*World Health Organization*) in 2017, the incidence of dysmenorrhea is relatively high worldwide. The average incidence of dysmenorrhea in young women is between 16.8% and 81% (WHO, 2017). Every woman has a different menstrual experience. Some women experience it without complaint, but others experience it with complaints, making it more uncomfortable.

Factors that can cause primary dysmenorrhea include nutritional status and physical activity. Adolescents with abnormal dietary status have a 1.2 times greater risk of developing dysmenorrhea.

Adolescents with less physical activity are 12.10 times more likely to experience dysmenorrhea compared to adolescents who have sufficient physical activity. (Aprilia et al., 2022). Factors that cause dysmenorrhea that often occur in women are a history of dysmenorrhea in the family, age at *menarche* (12 years), abnormal nutritional status, zinc and calcium intake. ≤(Putri et al., 2023).

Some micronutrients, such as zinc and calcium, can also help alleviate pain in primary dysmenorrhea, with or without side effects. The need for zinc during adolescence needs to be considered, as zinc can improve blood vessel circulation, thereby reducing cramps and pain associated with menstruation. (Ida, 2017). Based on an initial survey conducted by researchers at SMA Negeri 1 Rantau Selatan, the average zinc intake was determined through a 2-day 24-hour recall. Namely, 46% of respondents belong to the category of consuming less zinc.

Calcium functions for muscle contraction, which can reduce pain during menstruation (Ida, 2017). Adolescents who consume less calcium are 8.3 times more likely to experience dysmenorrhea compared to adolescents who consume adequate calcium intake. (Wildayani et al., 2023). Based on an initial survey conducted by researchers on November 4 and 6, 2023, at SMA Negeri 1 Rantau Selatan, it was found that 93% of female students experienced primary dysmenorrhea. Based on the results of this initial study, it is evident that the first and second day recalls were obtained, and 100% of the category of low calcium consumption was identified, with an average consumption of only 113 mg, which falls short of the recommended 1200 mg. Therefore, researchers are interested in conducting a study on the Relationship between Zinc and calcium intake and primary dysmenorrhea in Adolescent Girls at SMA Negeri 1 Rantau Selatan.

METHOD

This research was carried out at SMA Negeri 1 Rantau Selatan in July 2024. The research design used in this study is *Cross-sectional*. The sampling technique used was *purposive sampling* with inclusion criteria: (1) Female students in grades XI-3, XI-7, XI-8, and XI-9; (2) Willing to be a respondent; (3) In good health. Exclusion criteria: (1) Taking zinc and calcium supplements; (2) Not present during the research. The calculation in determining the number of samples uses the Lameshow formula. The sample in this study consisted of 44 class XI students, as determined by the school at SMA Negeri 1 Rantau Selatan.

The research instrument used in this study was a semi-quantitative Food *Frequency Questionnaire* (SQ-FFQ) *and a* Questionnaire *Numerical Rating Scale (NRS)* (de Arruda et al., 2022). Data collection was conducted by administering questionnaires, which respondents were guided through by the researchers. The data collected in this study are in the form of primary data, namely data on respondent characteristics, zinc intake, calcium intake, and primary dysmenorrhea experienced by adolescent girls at SMA Negeri 1 Rantau Selatan. The results of the zinc and calcium intake questionnaire were processed using the Nutrisurvey application and Microsoft Excel. Statistical testing is carried out using the chi-square test and logistic regression.

RESULTS AND DISCUSSION

Respondent Characteristics

The characteristics of the 44 respondents in this study are presented in Table 1. The data description is presented in the form of a table containing the mean (mean), standard deviation (SD), and percentage statistics.

Table 1. Distribution of Respondent Characteristics

Features	Total	
	n	%
A Piece of Cake (Per Month)		
Low (<Rp500,000)	29	65,9
Medium (IDR 500,000 – IDR 1,000,000)	12	27,3
High (>Rp1.000.000)	3	6,8
Rerata $\pm SD$	Rp501.136191.533$\pm$	
Age (years)		
16 years old	29	65,9
17 years	15	34,1
Rerata $\pm SD$	16,3$\pm$0,5	
Classes		
XI-3	13	29,5
XI-7	14	31,8
XI-8	15	34,1
XI-9	2	4,6
Menarche's Age		
Early (<11 years)	4	9,1
Normal (11 Years)≥	40	90,9
Rerata$\pm Sd$	12,11,0$\pm$	
Father's Education		
Elementary school/equivalent	6	13,6
junior high school/MTS/equivalent	3	6,8
High School/equivalent	25	56,8
Diploma/Universities	10	22,7
Mother's Education		
SD/MI/equivalent	6	13,6
junior high school/MTS/equivalent	2	4,6

Features	Total	
	n	%
High School/MA/equivalent	21	47,7
Diploma/Universities	15	34,1
Father's Work		
PNS	6	13,6
Private Employees	1	2,3
Self-employed	34	77,3
Farmer	3	6,8
Mother's Work		
Housewives	26	59,1
PNS	6	13,6
Private Employees	2	4,6
Self-employed	8	18,2
Labor	2	4,5

Based on the results of the respondent characteristics research in Table 1, it can be seen that from the age distribution, the majority of respondents were 16 years old, as many as 29 respondents (65.9%), and respondents aged 17 years were 15 respondents (34.1%), with an average of 16.3 years. Most respondents received pocket money per month <Rp500,000), as many as 29 respondents (65.9%).

Age of menarche is one of the causes of primary dysmenorrhea. Based on the results of a study, as many as four people (9.1%) experienced menstruation at the age of > 11 years, and as many as 44 people (90.9%) experienced menstruation at the age of 11 years. Based on research conducted by ≥Kurnia Apsara et al., (2023), saying that age menarche abnormalities can lead to primary dysmenorrhea.

This research also discusses education and parental work. Based on the study's results, it was found that the majority of young women with a high school education level are 25 people (56.8%), While Those with a Diploma/PT are 10 people (22.7%). The level of education of high school mothers is 21 people (47.7%), Diploma/PT is 15 people (34.1%). The study results were obtained from 34 young women, with 26 having a father who was self-employed (77.3%) and 8 having a mother who was a housewife (23.5%). A parent's education and work greatly influence how a child copes with and manages Dismenore Primer. Parents who have higher education and established jobs tend to have better knowledge, access to better medical care, and the ability to provide a healthier environment for the child. Conversely, inadequate education and employment

can limit a child's access to the information and care needed to reduce menstrual pain (Ambarwati & Hestiyah, 2022).

Zinc and Calcium Intake

Based on the study results in Table 2, it is evident that most adolescent girls have a low zinc intake, with 28 girls (63.6%) consuming less than the recommended amount. The average zinc intake of the respondents, at 6.1 mg/day (67.8% of the recommended adequacy), was classified as inadequate. This amount is still far from the recommended daily intake of zinc for adolescent girls aged 16 to 18 years, which is 9 mg/day (Ministry of Health of the Republic of Indonesia, 2019). The low frequency of consumption of zinc-rich foods can result in zinc intake that is less than adequate. This is in line with research conducted by Wati & Febriyatna, (2021)The results of the study showed that the zinc intake among the respondents was still in the low category, at 98.1%.

Additionally, it is also known that the calcium intake of adolescent girls at SMA Negeri 1 Rantau Selatan falls into the low category, with a total of 65.9%. The average calcium intake of the respondents, at 718.6 mg/day (59.8% of adequacy), fell within the underserved category. This amount is still far from the recommended daily intake of calcium for adolescent girls aged 16 to 18 years, which is 1200 mg/day (Ministry of Health of the Republic of Indonesia, 2019). The low frequency of consumption of calcium-rich foods can result in calcium intake that is less than adequate. This is in line with research conducted by Carolina & Devita, (2022)The results of the study indicate that the calcium intake among the respondents remains in the low category, at 51.6%.

Table 2. Distribution of Zinc and Calcium Intake

Intake Type	Category	Total	
		n	%
Zinc	Less (< 77%)	28	63,6
	Enough (77%)≥	16	36,4
	Total	44	100
	Rerata $\pm Sd$ (mg)	6,1$\pm$1,1	
Calcium	Less (< 77%)	29	65,9
	Enough(77%)≥	15	34,1
	Total	44	100
	Rerata $\pm Sd$ (mg)	718,6$\pm$195,8	

Dismenore Primer

Based on the study results, as shown in Table 4, it can be observed that 22 adolescent girls experience primary dysmenorrhea (50%), while the remaining 22 adolescent girls do not experience

primary dysmenorrhea (50%). The average primary dysmenorrhea score in adolescent girls is 3.9, which means that adolescent girls experience primary dysmenorrhea. This is in line with research conducted by Amany et al., (2022)The results of the study showed that most of the respondents had primary dysmenorrhea.

Table 4. Distribution of Primary Dysmenorrhea

Design Primer	Total	
	n	%
No dysmenorrhea (< 3)	22	50
Dismenore (3)≥	22	50
Total	44	100
Rerata $\pm Sd$	3,9±2,2	

The Relationship of Zinc Intake with Primary Dysmenorrhea in Adolescent Girls

Based on the results of the study presented in Table 5, it can be seen that adolescent girls experiencing primary dysmenorrhea have a 45.5% lower zinc intake. Adolescent girls who do not have primary dysmenorrhea consume 31.8% zinc intake. Based on test results, chi-square. The result was obtained, p=0.000 at a significant level of 0.05, which means that statistically, there is a relationship between zinc intake and primary dysmenorrhea in adolescent girls. The OR value = 14.566 means that adolescent girls who consume less zinc are 14.566 times more at risk of developing primary dysmenorrhea than adolescent girls who consume enough zinc. The results of this study are in line with the research conducted by Saraswati et al., (2020)The study results showed a significant relationship between zinc intake and primary dysmenorrhea, with a p-value of 0.000 (α < 0.05). Based on the results of the study Wati & Febriyatna, (2021), showed a significant relationship between zinc intake and the level of menstrual dysmenorrhea pain with a p-value of 0.042 (< 0.05). Adequate zinc intake can reduce pain during menstruation because zinc is an antioxidant and is part of the *follicle-stimulating hormone (FSH) and luteinizing hormone* (*LH*). In the ovarian cycle, secondary oocytes are released from the follicle when LH levels increase. One to 30 follicles begin to develop in the ovaries before ovulation under the influence of FSH and estrogen. The selected follicles are affected by an increase in LH before ovulation. Inside the selected follicle, oocytes develop (de Graaf's follicle), and ovulation occurs; the rest of the empty follicle turns into the corpus luteum. The corpus luteum reaches the peak of functional activity at 8 days after ovulation and secretes the hormones estrogen and progesterone. If fertilization does not occur, progesterone and estrogen levels decrease, causing the endometrial lining to break down, a process known as menstruation. In this phase, the endometrium produces prostaglandins in large quantities, which cause uterine contractions, reduce blood flow, and trigger the onset of pain, commonly referred to

as primary dysmenorrhea. (Sinaga et al., 2017). Zinc can also improve blood vessel circulation, which helps reduce cramps and menstrual pain. (Ida, 2017).

Table 5. *Chi-Square* Analysis of Zinc Intake with Primary Dysmenorrhea

No	Variabel	Dismenore Primer				*P*	OR (95% CI)
		Dismenore Primer		No Primary Dysmenorrhea			
	Zinc intake	n	%	n	%		
1	Less	20	45,5	8	18,2	0,000	14,566 (2,296 – 92,401)
2	Enough	2	4,5	14	31,8		

The Relationship between Calcium Intake and Primary Dysmenorrhea in Adolescent Girls

Based on the study results in Table 6, adolescent girls experiencing primary dysmenorrhea consume 45.5% less calcium. Adolescent girls who do not have primary dysmenorrhea consume calcium intake of 29.5%. Based on the test results, chi-square Results were obtained, with a p-value of 0.000 at a significance level of 0.05, indicating a statistically significant *relationship between calcium intake and primary dysmenorrhea in adolescent girls. The results of this study are in line with the research conducted by* Cia & Ghia, (2020)The study's results revealed a significant relationship between calcium intake and primary dysmenorrhea, with a p-value of 0.000 *(<0.05). Based on the results of the study* Kurniasari & Wirjatmadi, (2024)The study's results revealed a significant correlation between the level of calcium consumption and the incidence of primary dysmenorrhea among MAN 3 Tulungagung students, with a p-value of 0.028 ($p < 0.05$).

Alternatively, a value of 11,790 on the test chi-square indicates that adolescent girls with a lower calcium intake are 11,790 times more likely to develop primary dysmenorrhea than those with a sufficient calcium intake. The results of this study are in line with the research conducted by Cia & Ghia, (2020)The results of the study showed that an OR value of 12.923 indicates that adolescent girls at the Palangka Raya Health Polytechnic who consume less calcium are 12.923 times more likely to develop primary dysmenorrhea.

Adequate calcium intake can help reduce pain during menstruation because calcium helps relax muscles. If the muscles lack calcium, they cannot relax after contractions, which can cause cramps. The calcium ions that are actively released penetrate the plasma membrane and return into the sarcoplasmic reticulum, causing muscle relaxation. When calcium ions are cleared, myosin is dephosphorylated (its phosphate is removed) and can no longer interact with actin; the muscles will relax, reducing pain during menstruation. (Sherwood, 2018)

Table 6. *Chi-Square* Analysis of Calcium Intake with Primary Dysmenorrhea

No	Variabel	Dismenore Primer				*p*	OR (95% CI)
		Dismenore Primer		No Primary Dysmenorrhea			
	Zinc intake	n	%	n	%		
1	Less	20	45,5	8	18,2	0,000	14,566 (2,296 – 92,401)
2	Enough	2	4,5	14	31,8		

The Relationship of Zinc and Calcium Intake with Primary Dysmenorrhea in Adolescent Girls

Factors that can contribute to primary dysmenorrhea include sleep quality, physical activity, dietary habits, and nutritional status. Respondents with poor sleep quality had a 2.027 times greater risk of developing primary dysmenorrhea than respondents with good sleep quality (Nurfadillah et al., 2021). Respondents with poor eating habits tend to develop primary dysmenorrhea easily (Hayati et al., 2020). Adolescents with less physical activity are 12.10 times more likely to experience dysmenorrhea compared to adolescents who have sufficient physical activity (Aprilia et al., 2022). According to (2022), the better the nutritional status of adolescent girls, the less primary dysmenorrhea in adolescent girls will be. Factors that cause dysmenorrhea in women include a family history of dysmenorrhea, early menarche (12 years), prolonged menstrual cycles, and inadequate zinc and calcium intake (Sari et al., 2023).

Based on multivariate tests using logistic regression analysis, zinc intake variables significantly affected primary dysmenorrhea, with a p-value of 0.010, and calcium intake variables significantly affected primary dysmenorrhea, with a p-value of 0.004. This is in line with research Cia & Ghia, (2020)The study results showed a significant relationship between calcium intake and primary dysmenorrhea, with a p-value of 0.002 (< 0.05).

Table 7. Logistic Regression Test

Variabel	*p-value*	Odd-Ratio	95% CI (*Confidence Interval*)
Zinc Intake	0,010	14,566	2,296 – 92,401
Calcium Intake	0,004	11,790	1,805 – 77,020

Adequate intake of calcium and zinc can help reduce pain during menstruation, as zinc and calcium play a crucial role in alleviating the symptoms of primary dysmenorrhea by regulating uterine muscle contractions. Zinc has anti-inflammatory properties and plays a role in regulating the production of prostaglandins, compounds that trigger the contraction of the uterine muscles during menstruation. Calcium plays a crucial role in the contraction and relaxation of muscles, including

those of the uterus. Calcium deficiency can lead to uncontrolled muscle contractions and exacerbate menstrual pain. (Sinaga et al., 2017).

CONCLUSIONS AND SUGGESTIONS

Conclusion

Based on the results of the study, it can be concluded that most of the respondents who have a low intake of zinc and calcium experience primary dysmenorrhea. This is evidenced by the results of statistical analysis tests (multivariate), which show a significant relationship between the three. Adolescent girls who did not consume enough calcium were at risk of dysmenorrhea by 14,566, while those who did not consume zinc were at risk of dysmenorrhea by 11,790.

Suggestion

Adolescent girls need to pay attention to the intake of zinc and calcium to reduce the pain associated with primary dysmenorrhea and receive education regarding the importance of daily zinc and calcium intake.

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