INTERNASIONAL CONFERENCE ON
MULTIDISCIPLINARY APPROACHES IN HEALTH SCIENCE
VOLUME 2 , ISSN 3032-4408 (Online)
https://ejournal.poltekkes-denpasar.ac.id/index.php/icmahs

The Relationship between Nutritional Status Based on Body Mass Index (BMI) and Menstrual Cycle in Adolescent Girls at State Junior High School 1 Palu

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Article history
Posted : 2024-12-12
Reviewed : 2024-10-29
Received : 2023-10-03

ABSTRACT

Introduction: Poor nutritional status in adolescents can interfere with reproductive function and affect sexual maturation. World Health Organization (WHO) in 2014, an average of more than 75% of women experience menstrual disorders. Based on a preliminary survey of 7 students at State Junior High School (SJHC) 1 Palu located in the working area of the Singgani Health Center, there were 3 people who experienced menstrual disorders, 1 person was underweight. The problem of nutritional status at the Singgani Public Health Center is in the first place with 197 skinny categories and 120 obese people. This study aims to determine the relationship between nutritional status based on body mass index and the menstrual cycle. The research method: analytic with a cross sectional approach, the research population was students of State Junior High School (SJHC) Negeri 1 Palu class VII, the research sample was 63 respondents who were taken by simple random sampling method, research instruments using questionnaires and interviews. Results: The results of the study concluded that 46.0% of those who had a BMI were underweight, and 39.7% of those who had menstrual cycle abnormalities. The results of the analysis test using the Spearman Rank test and obtained ap value of 0.022 ($p < 0.05$). Conclusion: that there is a relationship between nutritional status based on body mass index (BMI) and the menstrual cycle at State Junior High School (SJHC) Negeri 1 Palu

Keywords: *Nutritional status, body mass index (BMI), menstrual cycle*

Introduction

The teenage years are a critical transition period from childhood to adulthood, marked by significant physical, psychological, and social changes. Adolescence is a time that poses great challenges in human development. (Mohamed and Mhmous 2019). At this time, adolescent girls experience bodily changes accompanied by issues related to menstruation, which is an important indicator of reproductive health. Irregular menstrual cycles are a gynecological issue experienced by women (Binu Thapa 2015). Regular and normal menstruation indicates that the body's reproductive functions are working well. However, in many teenagers, especially in developing countries, irregular menstrual cycles are often common. One of the factors that can affect the regularity of the menstrual cycle is nutritional status. Therefore, adequate nutrition is very important for adolescents who are menstruating so that their nutritional intake remains maintained. (Princess Amalia 2019).

Adolescents with poor nutritional status tend to experience disruptions in their reproductive function. This will lead to disruptions in their sexual maturity, Susanti and Lestari (2019). A lack of nutritional intake in adolescents will have adverse effects on their health. For example, there has been a decline in the concentration levels of learning among teenagers, as well as an increased susceptibility to illnesses. (Nugraheni 2017). Body mass index is one way to determine the nutritional status of adolescents by conducting anthropometric measurements. (JUE 2019).

Body mass index can affect menstrual disorders, as when women experience changes in certain hormones, for example, characterized by a drastic weight loss (BMI <18.5), it can influence hormones, leading to the production of immature eggs. This, of course, impacts the duration of menstrual cycle disruptions. (Astuti 2018). According to (Rahmawati 2017), a body mass index categorized as underweight can disrupt reproductive functions and affect growth and body organs. This will affect menstrual disturbances.

Women who experience obesity (BMI >27) can disrupt the balance of reproductive hormones, which will interfere with the menstrual cycle. (Novitasari 2016). According to Karlinah et al., excessively high fat reserves can increase androgens to estrogen, which disrupts the feedback of FSH, potentially leading to an extension of the menstrual cycle. (Karlinah and Irianti 2021).

In the research conducted by Dieny in 2014 (JUE 2019), it was found that during menstruation, the average blood loss is about 85ml, which is estimated to result in a loss of hemoglobin of around 133g/l. As a consequence, adolescent girls require more iron to replace the iron that has been lost.

Research conducted by Chowdhury et al. in 2019 in India states that body mass index plays a very vital role in the regularity of the menstrual cycle. Therefore, teenage girls should be provided with healthy and balanced nutrition, which leads to a normal body mass index balance and regulates their menstrual cycles. (Chowdhury and Chakraborty 2019).

Research conducted by Ganesh et al. revealed a relationship between body mass index and abnormal menstrual cycles such as polymenorrhea , oligomenorrhea, and amenorrhea. (Ganesh and Ilona , L & Fadil 2015). The amount of fat in the body affects the secretion and performance of reproductive hormones, as adipose tissue plays a role in forming, converting, and storing reproductive hormones that regulate the menstrual cycle.

Excess fat can lead to an increase in estrogen levels, causing prolonged menstrual cycles. (El Alasi, Z, Y & Hamdani 2017).

Based on previous research, the advantage of this study is that the researchers found that the majority of respondents had a low BMI, with 29 individuals (46.0%). The results from interviews and questionnaire responses indicated that many teenagers skip breakfast, with 58.6% having a meal pattern of only two meals a day. This is linked to the availability of fast food around the school; they do not have breakfast at home and always consume fast food while at school, resulting in inadequate nutritional intake for teenagers, which can lead to an unhealthy weight based on BMI.

Based on data from the World Health Organization (WHO) in 2014, as cited in Tanisiwa et al. (2019), it is known that an average of more than 75% of women suffer from menstrual disorders. There are many factors that cause infertility. Included due to menstrual disturbances. In Indonesia, the highest disruption to reproductive health function is caused by menstrual cycle disorders, with a prevalence of around 45% according to WHO (2012). (Paspariny , 2017) .

Based on the National Riskesdas report (2018), the prevalence of nutritional status (BMI/A) among adolescents aged 13-15 years in Indonesia is as follows: 1.9% are classified as very thin, 6.8% thin, 75.3% normal, 11.2 % overweight, and 4.8% obese (National Riskesdas Report 2018). Meanwhile, Wulandari states that in Indonesia, the prevalence of adolescents with a BMI of more than 5.7% and 1.6% are experiencing obesity (Wuladari 2021). According to Riskesdas data (2018), the prevalence of nutritional status (BMI/A) among the population aged 13-15 years in Central Sulawesi province, by district/city, is as follows: 2.44% very thin, 7.47% thin, 78.87 % normal, 8.14% overweight, and 3.10% obese. Specifically in Palu City, the percentages are: 2.71% very thin and 4.12% experiencing obesity. (Report Central Sulawesi Province , Riskesdas , 2018).

According to data from the Health Office of Palu City, there are 4,559 adolescent girls in the working area of the Singgani Health Center. This figure represents the highest number of adolescent girls in Palu City. Meanwhile, the lowest number was found in the working area of the Tipo Health Center, which had 690 adolescent girls. The issue of nutritional status at the Singggani Community Health Center ranks first, with 197 individuals categorized as underweight and 120 individuals categorized as obese. The secondary schools included in the working area of the Singggani Community Health Center are: State Junior High School (SJHC) 14 Palu, SJHC 15 Palu, SJHC Labschool Palu, SJHC 1 Palu, and SJHC 4 Palu. In addition, the lack of knowledge about balanced nutrition and reproductive health among adolescents also exacerbates this issue. Many teenagers are unaware of the importance of maintaining a healthy nutritional status to support their reproductive health. As a result, many experience menstrual problems, which can ultimately impact their long-term health, including the risk of infertility and other reproductive diseases in the future.

Based on data from the Education and Culture Office of Palu City, the number of female students at SJHC 14 is 184, SJHC 15 is 159, SJHC Labschool is 146, SJHC 1 is 569, and SJHC 4 is 468.

According to a preliminary survey conducted on January 11, 2022, at SJHC 1 Palu, which is one of the largest middle schools in Palu City located within the working area of the Singgani Health Center. This survey location was chosen because the school has the largest population, with 567 female students, and 184 female students in the seventh grade. The survey was conducted through interviews and

BMI calculations (based on the last recorded weight and height). Nutritional issues among teenage girls were also a concern, as many reported experiencing problems with the regularity of their menstrual cycles. Most of them also have an inadequate nutritional status, either falling into the underweight or obesity category.

Based on the results of the preliminary survey and observing this phenomenon, further research is needed to explore the relationship between nutritional status based on BMI and the menstrual cycle in adolescent girls at SJHC 1 Palu. This study is expected to provide a clearer picture of the influence of nutritional status on the regularity of the menstrual cycle, thus serving as a foundation for appropriate interventions to improve the reproductive health of adolescent girls.

This research is also relevant in the context of health policy in Indonesia, which is currently focused on improving adolescent health as part of efforts to prevent non-communicable diseases (NCDs) and reproductive health issues. With the results of this research, it is hoped that the school, health workers, and local government can collaborate to provide more effective education and interventions to improve the nutritional status of adolescent girls, so that they can have regular menstrual cycles and better reproductive health .

Research Method

A. Types and Research Design

This research employs an analytical research design with a cross-sectional approach to determine the relationship between nutritional status based on BMI and the menstrual cycle among female students of SJHC Negeri 1 Palu, where the research subjects were observed only once and measurements were taken regarding the status of characteristics or variables of the subjects at the time of examination through data collection. This research aims to find a relationship between the independent variable (nutritional status) and the dependent variable. (cycle menstruation).

B. Time and Place of Research

This research was conducted at SJHC Negeri 1 Palu. The research took place from April 18 to April 22, 2022.

C. Population and Sample

The population in this study consists of seventh-grade female students from SJHC Negeri 1 in Palu City, totaling 184 adolescent girls, with the sample taken being those who have already menstruated. Because this research focuses on vulnerable early adolescents aged 11-14 years. In early adolescence, sudden changes occur, often in a chaotic manner. At this age, teenagers need to understand that their nutritional status is very important and significantly affects their health, especially during menstruation. Therefore, by the time their next menstruation arrives, they should have taken steps to prevent both nutritional deficiencies and excesses by obtaining nutritious food and maintaining their weight. Sample, The formula used to measure the sample size using the Lemeshow formula resulted in 63 individuals for this study. The sampling method in each class employed simple random sampling, selecting 63 individuals from 11 classes. In this research, the sampling technique utilized simple random sampling, where each individual in the population has an equal chance of being selected as a sample; this technique employs a lottery method.

D. Data collection techniques

Data collection techniques by measuring body weight and height and interviews regarding the menstrual cycle by filling out questionnaires. This research was conducted at SMP Negeri 1 Palu with the implementation of activities taking place from April 18 to April 22, 2022.

Results and Discussions

Table 1. Frequency Distribution Based on Respondent Characteristics at SJHC Negeri 1 Palu

Characteristics	frequency	Percentage (%)
Age		
12 years	15	23.8
13 years	45	71.4
14 years	3	4.8
Body weight (kg)		
30-40	26	41.3
41-50	21	33.3
51-60	13	20.6
61-70	1	1.6
>70	2	3.2
Height (cm)		
140-150	20	31.7
151-160	38	60.3
161-170	5	7.9
EatingPatterns		
2X/Day	37	58.7
3X/Day	26	41.3
menstrual period		
3-8 Days	62	98.4
>8 Days	1	1.6

Change the pad		
2X/ day	5	7.9
3X/ day	37	58.7
4X/ day	21	33.3

Source: Primary Data, 2022

Table 1 shows that the majority of respondents were 13 years old, with a total of 45 respondents (71.4%). The majority of respondents have a weight of 30-40 kg, totaling 26 respondents (41.3%). The majority have a height of 151-160 cm, amounting to 38 respondents (60.3%). The majority have an eating pattern of 2 times a day, with 37 respondents (58.7%). The majority experience menstruation lasting 3-8 days, totaling 62 respondents (98.4%), and the majority change their period 3 times a day, with 37 respondents (58.7%).

Table 2. The relationship between nutritional status based on Body Mass Index (BMI) and the menstrual cycle at SJHC Negeri 1 Palu.

	menstrual cycle				**Total**		pp	r
body mass index	Normal		Abnormal					
	N	%	N	%	N	%		
Normal	22	34.9%	5	7.9%	27	42.9%		
underweight	11	17.5%	18	28.6%	29	46.0%		
overweight	5	7.9%	2	3.2%	7	11.1%		
Total	38	60.3%	25	39.7%	63	100.0%	0.022	0.287

Source: Primary Data, 2022

Table 2 shows the interpretation of the table above, and it was found that 38 adolescents (60.3%) experienced a normal menstrual cycle. This means that the majority of them experience a normal menstrual cycle. However, as many as 25 teenagers (39.7%) experienced irregular menstrual cycles. There are 7 female students categorized as having a high BMI, and 2 (3.2%) of them experience menstrual cycle irregularities. Meanwhile, 29 female students fell into the underweight category, and 18 (28.6%) of them had abnormal menstrual cycles. Then there were 27 female students who fell into the normal BMI category, and 5 (7.9%) of them experienced irregular menstrual cycles.

The Relationship Between Nutritional Status Based on Body Mass Index (BMI) and the Menstrual Cycle of Adolescent Girls at SJHC Negeri 1 Palu

Based on the results of the Spearman rank test, there is a strong relationship between nutritional status based on body mass index (BMI) and the menstrual cycle, with a fairly positive correlation (p=0.022, r=0.287). Most respondents have a low BMI and have irregular menstrual cycles (28.6%).

The sexual maturation of adolescent girls will be disrupted if their nutrition is insufficient. In addition, it will affect the growth of body organs and may lead to reproductive disorders. This condition will affect their menstrual cycles. This condition will only improve if their nutrition is adequate. Meanwhile, if their nutritional intake is insufficient, their menstrual cycles are likely to experience irregularities. On the other hand, BMI affects the menstrual cycle. Individuals categorized as overweight have fat accumulated in their bodies, which influences their body temperature and can lead to irregularities in their menstrual cycles. This condition also applies to those categorized as underweight; their BMI will impact the irregularities in their menstrual cycles as well. (Susanti and Lestari, 2019).

Women who experience obesity or have high levels of body fat produce more androstendione . Androstenedione itself is an androgen that can act as a precursor for hormone production. Through the action of the enzyme aromatase, androgens are converted into estrogen. This aromatization, where androgens transform into estrogen, occurs in adipose tissue and granulosa cells. Therefore, the amount of fat in body tissue can disrupt the menstrual cycle, as estrogen is increasingly produced in fat tissue, and too much estrogen disrupts hormonal balance. (Ruqaiyah & Fauziah, 2021).

If the nutritional status of adolescents is good, then their reproductive system is also good, and there are no obstacles. The research results with 27 respondents who had a normal BMI showed that 5 individuals (7.9%) experienced irregular menstrual cycles. That the results of this research indicate that the function of the reproductive system requires adequate and good nutrition, and it is also important to consider psychological factors. Because even if nutrition is sufficient, psychological disturbances can still lead to disruptions in the reproductive system. (Berty, 2018)

The amount of estrogen will increase when body fat is high. This condition will prolong the duration of the menstrual cycle due to an increase in estrogen in the blood. High levels of estrogen will negatively impact the secretion of GnRH, which will then affect the menstrual cycle. The influence of the hypothalamus is also related, as stress can lead to the suppression of the hypothalamus. Women with a low body weight will reduce estrogen production. Disruption of fat will lead to the cessation of estrogen formation. Disruption of fat will also cause the halt of cholesterol formation, which is converted into extra estrogen. Such conditions cause menstruation to become longer, which

means that a woman's menstrual cycle is disrupted. (Tanisiwa et al. , 2019)

This research is supported by previous research conducted by Ruqaiyah in 2021 entitled "The Relationship Between Body Mass Index and Menstrual Cycle Among Pelamonia Makassar AKBID Students." A Chi-Square test was conducted and showed results indicating a relationship between BMI and the menstrual cycle. This relationship is indicated by a p-value of 0.000. Amperaningsih (2019) in her research on the relationship between nutritional status and the menstrual cycle in adolescents in Bandar Lampung concluded that respondents with a higher Body Mass Index (BMI) experienced more irregularities in their menstrual cycles. Based on the study results, out of 7 respondents with a BMI classified as obese, 2 (3.2%) experienced irregular menstrual cycles. This indicates that an abnormal BMI leads to irregular menstrual cycles due to higher fat levels, which increases estrogen production and results in longer menstrual cycles. (Zaki Yatun Usna El Alasi, 2017). Menstrual irregularities are not only due to BMI factors, but can also be caused by hormones, psychological factors (stress), lack of activity, not exercising regularly, and an unbalanced diet. Nutritional imbalance among teenagers is common due to their irregular eating habits, such as skipping breakfast and not eating three meals a day. They also consume a lot of instant foods that are low in nutritional value, such as candies, chocolate, noodles, fried foods, and so on.

The lack of nutrition in the body will lead to a decline in reproductive function. This can lead to hypothalamic disturbances. Because, in the case of gonadotropins experiencing a decline, there will also be a decrease in the secretion of FSH, as well as estrogen and progesterone hormones. This condition will cause mature eggs to stop forming and will lead to disruptions in the menstrual cycle. (Astuti & Noranita , 2016)

Other factors that influence the menstrual cycle include genetics, endocrine disorders, and reproductive diseases. Genetics can influence the menstrual cycle because a mother's menstrual cycle can affect her child's menstrual cycle. A mother with a regular menstrual cycle will have a child with a regular menstrual cycle as well. Meanwhile, endocrine disorders, such as hypothyroidism, hyperthyroidism, and diabetes mellitus, also affect the occurrence of menstrual cycle disturbances. Individuals with hypothyroidism will have a higher risk of experiencing menorrhagia and polymenorrhea . Hyperthyroidism will increase the risk of amenorrhea and oligomenorrhea. Polycystic ovary syndrome, Polycystic ovary syndrome, including type II diabetes mellitus, which commonly occurs in obese patients, is one of the risk factors that can lead to the emergence of oligomenorrhea. Meanwhile, reproductive diseases, such as ovarian tumors, endometriosis, polycystic ovary syndrome, and cervical cancer, can also lead to hormonal changes that disrupt a person's menstrual cycle. (Ruqaiyah & Fauziah, 2021)

Conclusion

The research results show that the respondents, or the majority of the female students, have a Body Mass Index (BMI) classified as underweight, and most of them experience a normal menstrual cycle. It is also known that there is a relationship between nutritional status based on body mass index (BMI) and the menstrual cycle at SJHC Negeri 1 Palu. The results of this study are expected to encourage those responsible for the school health program to pay attention to nutritional status in relation to food intake and to maintain

weight, as adolescent girls experience menstruation every month, which may be related to the menstrual cycle.

Acknowledgement

The authors would like to thank State Junior High School 1 Palu and the respondents for giving the opportunity and helping to conduct the research.

Conflic of Interest

The author declares that he has no conflict of interest.

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