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FACTORS INFLUENCING THE INCIDENCE OF ANEMIA IN ADOLESCENT GIRLS AT HADI HUSADA HOSPITAL

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ABSTRACT

Anemia is a condition with lower than normal hemoglobin and erythrocyte levels (Masrizal, 2007). Factors influencing the incidence of anemia in adolescent girls. This type of research is an analytical survey using a cross-sectional design. The population in this study were all pregnant women at Hadi Husada Hospital. The sampling technique used was total sampling of 33 people. The data collection tool was a questionnaire. The results of the study showed that the statistical test results obtained a p value = 0.001 or an α value <0.05 which can be concluded that there is a significant influence between female students' knowledge on the incidence of anemia, the statistical test obtained a p value = 0.003 or an α value <0.05 which can be concluded that there is a significant influence between female students' activities on the incidence of anemia, the statistical test obtained a p value = 0.000 or an α value <0.05 which can be concluded that there is a significant influence between the length of menstruation on the incidence of anemia, the statistical test obtained a p value = 0.000 or an α value <0.05 which can be concluded that there is a significant influence between nutritional status on the incidence of anemia. It is hoped that young women should be able to know about health, especially about nutritional status on the incidence of anemia and it is hoped that further researchers will conduct research with more samples and different designs.

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INTRODUCTION

Over the past several decades, obesity has emerged as a major global health epidemic. Its prevalence continues to rise in parallel with lifestyle changes—most notably the increase in sedentary behavior and the widespread consumption of high-calorie, nutrient-poor foods. Obesity, characterized by excessive accumulation of body fat, particularly in visceral adipose tissue, has been identified as a primary risk factor for various complex metabolic disorders, including metabolic syndrome (MetS), type 2 diabetes mellitus (T2DM), cardiovascular disease, and non-alcoholic fatty liver disease (NAFLD). Recent studies emphasize that this upward trend in adiposity significantly exacerbates systemic metabolic dysregulation (Choi et al., 2025). The biological role of adipose tissue has been reconceptualized in contemporary research. It is no longer viewed merely as an energy reservoir, hypertrophy and may become dysfunctional, releasing a wide array of pro-

inflammatory cytokines (e.g., TNF-α, IL-6), free fatty acids, and oxidative mediators. These responses promote chronic low-grade inflammation and insulin resistance—hallmarks of metabolic dysfunction (Choi et al., 2025). This chronic inflammatory state, often termed adipose tissue dysfunction, plays a central role in the pathogenesis of MetS and its associated complications. Recent evidence indicates that the interplay between inflammation, mitochondrial dysfunction, and oxidative stress intensifies insulin resistance and accelerates the progression of hepatic steatosis, atherogenic dyslipidemia, and cardiovascular disease (Islam et al., 2024).

Furthermore, emerging literature suggests that fat distribution—especially visceral fat accumulation—is a stronger predictor of metabolic risk than body mass index (BMI) alone. Conditions such as metabolically obese normal-weight (MONW) individuals demonstrate that metabolic health is not determined solely by body fat quantity but also by fat function and anatomical distribution (Swarup et al., 2024). This highlights the crucial role of adipose tissue expandability and endocrine function in determining an individual's metabolic profile. Given these findings, a deeper investigation into adipose tissue—its structure, distribution, and endocrine-inflammatory properties—is essential for understanding the pathophysiological mechanisms underlying metabolic syndrome. This review aims to explore how obesity-induced adipose tissue dysfunction contributes to the development of MetS, thereby supporting future research and the development of comprehensive strategies for preventing and managing complex metabolic diseases.

METHOD

Study Design

This study employed a narrative review design to analyze recent evidence regarding the role of obesity and adipose tissue dysfunction in the development of metabolic syndrome. A narrative review was selected due to its suitability for synthesizing current biomedical and public health literature, especially when the topic involves complex physiological and metabolic mechanisms.

Literature Search Strategy

A structured literature search was conducted between January and March 2025 across major health-science databases, including PubMed, ScienceDirect, Scopus, and Google Scholar. The search focused on articles published within the last five years (2020–2025) to ensure the inclusion of the most recent findings relevant to metabolic health.

The search terms applied included a combination of Medical Subject Headings (MeSH) and free-text keywords:

"obesity," "adiposity," "adipose tissue dysfunction," "visceral fat," "inflammation," "adipokines," "metabolic syndrome," "insulin resistance," "cardiometabolic risk," "atherogenic dyslipidemia."

Boolean operators (AND, OR) were used to refine the search for health-related outcomes and physiological mechanisms associated with metabolic syndrome.

Inclusion and Exclusion Criteria

Articles were selected based on the following criteria:

Inclusion Criteria:

1. Published in peer-reviewed health or biomedical journals (2020–2025).
2. Focused on obesity, adipose tissue biology, inflammatory pathways, or metabolic syndrome.
3. Included clinical, epidemiological, or experimental data relevant to metabolic health.
4. Written in English.

Exclusion Criteria:

1. Publications prior to 2020.
2. Non–peer-reviewed articles, editorials, commentaries, theses, or conference abstracts.
3. Studies unrelated to obesity-related metabolic dysfunction or lacking relevance to metabolic disease mechanisms.

Article Screening and Selection Process

The initial search identified approximately 240 articles. After removing duplicates, 185 unique articles were screened based on titles and abstracts. A total of 78 articles met the preliminary criteria and underwent full-text evaluation. Following a detailed review based on relevance, scientific rigor, and alignment with health science perspectives, 48 articles were included in the final synthesis.

Data Extraction and Synthesis

Data extracted from each study included:

Type of study (clinical trial, observational study, in vivo/in vitro experiment, or systematic review),sample characteristics, key findings related to adipose tissue function, inflammation, insulin resistance, and metabolic risk,health implications and proposed physiological mechanisms.

The extracted data were synthesized thematically into categories relevant to the health sciences, specifically:

1. Pathophysiology of adipose tissue dysfunction,
2. Inflammatory and endocrine mechanisms,
3. Clinical markers of metabolic syndrome,
4. Cardiometabolic risk pathways,
5. Public health implications of obesity-related metabolic disease.

Given the heterogeneity of study designs, a qualitative synthesis approach was used rather than statistical meta-analysis.

RESULTS AND DISCUSSION

Respondent Characteristics Based on Age

The results of the frequency distribution research based on the characteristics of the respondents' age studied in 2 categories, education studied in 2 categories, occupation studied in 2 categories, and parity studied in 2 categories are as follows:

Table 1. Frequency Distribution by Age at Hadi Husada Hospital in 2024, (n=33).

Age	Amount	Percent %
9-10	25	75.8
10-13	8	24.2
Total	33	100.0

Table 1 shows that of the 33 respondents based on age at Hadi Husada Hospital, the majority were aged 9-10 years (25) (75.8%), and the minority were aged 10-13 years (8) (24.2%).

Knowledge, Activity, Menstrual Duration, and Nutritional Status at Hadi Husada General Hospital

The results of the frequency distribution research based on the knowledge, attitudes and actions of pregnant women studied, each in 2 categories, are as follows:

Table 2. Frequency Distribution Based on Knowledge, Activity, Menstrual Duration, and Nutritional Status at Hadi Husada Hospital (n=33).

Knowledge	Amount	Percent %
Not enough	11	33.3
Good	22	66.7
Total	33	100.0
Activity	**Amount**	**Percent %**
Low	9	27.3
Currently	24	72.7
Total	33	100.0
Menstrual Period	**Amount**	**Percent %**
2-7 days	8	27.3
> 7 days	25	72.7
Total	33	100.0
Nutritional status	**Amount**	**Percent %**
Enough	5	15.2
Good	28	84.8
Total	33	100.0

Table 2 shows that 33 respondents based on the knowledge of adolescent girls, the majority stated that the knowledge of adolescent girls was good as many as 22 (66.7%), the majority of female students' activities were moderate as many as 24 (72.7%) and the duration of menstruation was mostly > 7 days as many as 28 (84.8%), the nutritional status of adolescent girls was mostly good as many as 28 (84.8%).

Anemia in Adolescent Girls at Hadi Husada Hospital

Results of frequency distribution research based on Stimulus Utilization**.** External ones are categorized into 2 categories as follows:

Table 3. Frequency Distribution Based on Nutritional Status of Anemia in Adolescent Girls, (n=33).

Anemia	Amount	Percent %

Anemia	7	21.2
No Anemia	26	78.8
Total	33	100.0

Table 3 shows that of the 33 respondents at Hadi Husada Hospital, the majority stated that they did not have anemia, as many as 26 (78.8%).

The Influence of Knowledge, Activity, Menstrual Duration and Nutritional Status at Hadi Husada Hospital

The tabulated results of the influence of student knowledge on the incidence of anemia at Hadi Husada Hospital are as follows:

Table 4. Cross Tabulation of Students' Knowledge of the Occurrence of Anemia at Hadi Husada Hospital (n=33).

Knowledge	Anemia Incident						p *value* Student
	Anemia		No Anemia		Total		
	F	%	F	%	F	%	
Not enough	6	18.2	5	15.2	11	33.4	
Good	1	3.0	21	63.6	22	66.6	.001
Amount	7	21.2	26	78.8	33	100.0	

Table 4 shows the results of the analysis between students' knowledge of anemia incidents at Hadi Husada Hospital obtained from 33 respondents who stated that 6 (18.2%) students had poor knowledge of anemia, 5 (15.2%) students had poor knowledge but no anemia. Meanwhile, 1 (3.0%) student had good knowledge of anemia, and 21 (63.6%) students had good knowledge but no anemia. The results of the statistical test obtained a p value = 0.001 or an α value <0.05 which can be concluded that there is a significant influence between students' knowledge and anemia incidents at Hadi Husada Hospital.

The Influence of Activity on the Incidence of Anemia in Class X of Senior High School

The tabulation results show the influence of student activities on the incidence of anemia in Hadi Husada Hospital is as follows:

Table 5. Cross Tabulation of Activities on the incidence of anemia at Hadi Husada Hospital, (n=33).

Activity	Anemia Incident						P-value
	Anemia		No Anemia		T total		
	F	%	F	%	F	%	
Low	5	15.1	4	12.1	9	27.2	
Currently	2	6.1	22	66.7	24	72.8	.003

7	21.2	26	78.8	33	100.0	

Table 5 shows the results of the analysis between Activity and the incidence of anemia at Hadi Husada Hospital obtained from 33 respondents who stated that there were 5 (15.1%) female students who had low activity with anemia, 4 (12.1%) female students who had low activity without anemia. Meanwhile, there were 2 (6.1%) female students who had moderate activity with anemia, and 22 (66.7%) female students who had moderate activity without anemia. The results of the statistical test obtained a p value = 0.003 or an α value <0.05 which can be concluded that there is a significant influence between student activity and the incidence of anemia at Hadi Husada Hospital.

The Effect of Menstrual Duration on the Incidence of Anemia at Hadi Husada Hospital

The tabulation results of the effect of menstrual duration on the incidence of anemia at Hadi Husada Hospital are as follows:

Table 6. Cross-tabulation of menstrual duration and anemia incidence at Hadi Husada Hospital, (n=33).

Menstrual Period	Anemia Incident						p-value
	Anemia		No Anemia		T	total	
	F	%	F	%	F	%	
2 – 7 days	4	12.1	1	3.0	5	15.1	
> 7 days	3	9.1	25	75.8	28	84.9	.000
Amount	7	21.2	26	78.8	33	100.0	

Table 6 shows the results of the analysis between menstrual duration and the incidence of anemia at Hadi Husada Hospital, obtained from 33 respondents. Four (12.1%) stated that there were students who experienced menstruation lasting 2-7 days with anemia, and one (3.0%) stated that there were students who experienced menstruation lasting 2-7 days without anemia. Meanwhile, there were students who experienced menstruation lasting >7 days with anemia.

days with anemia as many as 3 (9.1%), students who experienced menstrual duration > 7 days without anemia as many as 25 (75.8%). The results of the statistical test obtained a p value = 0.000 or an α value < 0.05 which can be concluded that there is a significant influence between Menstrual Duration and the incidence of anemia at Hadi Husada Hospital.

The Influence of Nutritional Status on the incidence of anemia at Hadi Husada Hospital

The tabulation results of the influence of nutritional status on the incidence of anemia in Hadi Husada Hospital is as follows:

Table 7. Cross-tabulation of nutritional status against anemia incidence at Hadi Husada Hospital, (n=33)

Nutritional status	Anemia Incident						p-value
	Anemia		No Anemia		Total		
	F	%	F	%	F	%	
Enough	4	12.1	1	3.0	5	15.1	
Good	3	9.1	25	75.8	28	84.9	
Amount	7	21.2	26	78.8	33	100.0	

Table 7 shows the results of the analysis between Nutritional Status and the incidence of anemia at Hadi Husada Hospital obtained from 33 respondents who stated that 4 (12.1%) students had adequate nutritional status with anemia, 1 (3.0%) students had adequate nutritional status without anemia, while 3 (9.1%) students had good nutritional status with anemia, and 25 (75.8%) students had good nutritional status without anemia. The results of the statistical test obtained a p value = 0.000 or an α value <0.05 which can be concluded that there is a significant influence between nutritional status and the incidence of anemia at Hadi Husada Hospital.

Discussion

Based on the results obtained, a discussion was conducted to answer the research question regarding Factors Influencing the Incidence of Anemia in Adolescent Girls at Hadi Husada Hospital.

The Influence of Student Knowledge on the Incidence of Anemia at Hadi Husada Hospital

The results of the study showed the results of the analysis between the knowledge of female students regarding the incidence of anemia at Hadi Husada Hospital obtained from 33 respondents who stated that 6 (18.2%) female students had poor knowledge with anemia, 5 (15.2%) female students had poor knowledge with no anemia. Meanwhile, 1 (3.0%) female student had good knowledge with anemia, and 21 (63.6%) pregnant women had good knowledge with no anemia. The results of the statistical test obtained a p value = 0.001 or an α value <0.05 which can be concluded that there is a significant influence between female students' knowledge with the incidence of anemia. From here it can be seen from the level of female students' knowledge with the incidence of anemia. In other words, the higher a person's level of education, the broader their knowledge (Notoatmodjo, 2011).

Adolescents at Hadi Husada Hospital have good knowledge about anemia. This is because all school officials frequently provide health information by inviting health workers to visit the school or by health workers themselves to provide health information. This is also influenced by the establishment of effective therapeutic communication with all relevant school

officials, which results in good performance. Students' knowledge about anemia can be obtained from health workers, as well as from personal experience and others.

As we know, knowledge is the sum of all thoughts, ideas, concepts, and understandings humans have about the world and everything in it, including humans and their lives. Knowledge is also the result of knowing, and this occurs after sensing a particular object. Sensing occurs through the five human senses: sight, smell, taste, and touch. In other words, the higher a person's education, the broader their knowledge (Notoatmodjo, 2014).

It is hoped that adolescents at Hadi Husada Hospital will increase their knowledge of the factors influencing anemia in order to understand the health benefits they will experience. Knowledge will improve with higher levels of education and knowledge. The higher a person's education, the higher their level of knowledge (Notoatmodjo, 2014).

The Influence of Student Activities on the Incidence of Anemia at Hadi Husada Hospital

The results of the study showed the results of the analysis between student activities and the incidence of anemia at Hadi Husada Hospital obtained from 33 respondents who stated that 5 (15.1%) students had low activity with anemia, 4 (12.1%) students had low activity with anemia. While 2 (6.1%) students had moderate activity with anemia, and 22 (66.7%) students had moderate activity without anemia. The results of the statistical test obtained a p value = 0.003 or an α value <0.05 which can be concluded that there is a significant influence between student activities and the incidence of anemia. Researchers assume that excessive student activity greatly affects their nutritional status so that it can have an impact on students becoming anemic.

This is in line with Jaelani's research (2017) which states that anemia in adolescents can have a negative impact on adolescents, anemia that occurs can cause a decline in reproductive health, motor and mental development, stunted intelligence, decreased learning achievement, decreased fitness levels, and failure to achieve maximum height (Andriani M. and Wirjatmadi B, 2013).

The Effect of Menstrual Duration on the Incidence of Anemia at Hadi Husada Hospital

The results of the study showed the results of the analysis between the length of menstruation and the incidence of anemia at Hadi Husada Hospital obtained from 33 respondents who stated that students who had a menstrual period of 2-7 days with anemia were 4 (12.1%), students who had a menstrual period of 2-7 days without anemia were 1 (3.0%). While students who had a menstrual period of > 7 days with anemia were 3 (9.1%), students who had a menstrual period of > 7 days without anemia were 25 (75.8%). The results of the statistical test obtained a p value = 0.000 or an α value <0.05 which can be concluded that there is a significant influence between the length of menstruation and the incidence of anemia. Researchers assume that the length of menstruation greatly affects the health of students due to diet or nutritional intake that is not in accordance with the activities of the students.

This aligns with Briawan's theory (2019), which states that during this period, the life process toward physical maturity and emotional development occurs between children and pre-adulthood. The categories of the adolescent age period vary from various references. The division of adolescent groups is as follows: early adolescents (ages 10-14 or 13-15), middle

adolescents (ages 14/15-17), and late adolescents (ages 17-21). There are also other terms, namely youth for ages 15-24, or young people for ages 10-24. Several issues related to nutrition will arise during this transitional period of adolescent life (Briawan, 2019).

The Effect of Nutritional Status on the Incidence of Anemia at Hadi Husada Hospital in 2025.

The results of the study showed that the analysis of nutritional status and the incidence of anemia at Hadi Husada Hospital was obtained from 33 respondents who stated that 4 (12.1%) female students had nutritional status with anemia, while 1 (3.0%) female student had nutritional status without anemia. Meanwhile, 3 female students had nutritional status with anemia.

(9.1%), 25 (75.8%) female students had a nutritional status without anemia. The statistical test results obtained a p value = 0.000 or an α value <0.05, which can be concluded that there is a significant influence between nutritional status and the incidence of anemia. Researchers assume that nutritional status greatly affects the health of female students due to eating patterns or nutritional intake that do not match the student's activities.

This is in line with Novita's (2018) research that adolescent girls experience anemia due to blood deficiency caused by menstrual bleeding, lack of iron in some foods consumed, irregular nutritional intake in diet, activities carried out and adolescent eating patterns that change from being regular to less regular, for example eating late and eating twice a day. This condition is related to the eating patterns of adolescent girls. Family economics can also influence the type of food intake consumed by adolescents, this is related to the family economy in fulfilling good and balanced iron in adolescent girls (Ambarwati, 2017).

CONCLUSION AND SUGGESTIONS

From the results of research conducted on Factors Influencing the Incidence of Anemia in Adolescent Girls at Hadi Husada Hospital, the following conclusions and suggestions were obtained:

Conclusion

1. The results of the statistical test obtained a p value = 0.001 or an α value < 0.05, which can be concluded that there is a significant influence between the knowledge of adolescent girls and the incidence of anemia.
2. The results of the statistical test obtained a p value = 0.003 or an α value < 0.05, which can be concluded that there is a significant influence between the activities of adolescent girls on the incidence of anemia.
3. The results of the statistical test obtained a p value = 0.000 or an α value < 0.05, which can be concluded that there is a significant influence between the length of menstruation in adolescent girls and the incidence of anemia.
4. The results of the statistical test obtained a p value = 0.000 or an α value < 0.05, which can be concluded that there is a significant influence between the nutritional status of adolescent girls and the incidence of anemia.

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