International Journal of Advanced Health Science and Technology e-ISSN:2808-6422; p-ISSN:2829-3037
Homepage: ijahst.org Vol. 5 No.5, pp. 317-320, October 2025

RESEARCH ARTICLE OPEN ACCESS

Manuscript received September12, 2023; revised Oktober 12, 2023; accepted Oktober 12, 2023; date of publication December 30, 2023

Digital Object Identifier (**DOI**): https://doi.org/10.35882/ijahst.v5i5.486

How to cite: Afitsya Salsa Ayudi, Teta Puji Rahayu, Agung Suharto and Nuryani. "The Impact of Waist-Hip Ratio (WHR) on Premenstrual Syndrome (PMS) in Adolescents", International Journal of Advanced Health Science and Technology, Vol. 5, No. 5, pp. 335-340, October 2025

The Impact of Waist-Hip Ratio (WHR) on Premenstrual Syndrome (PMS) in Adolescents

Afitsya Salsa Ayudi, Teta Puji Rahayu, Agung Suharto and Nuryani

Department of Midwifery, Poltekkes Kemenkes Surabaya, Surabaya, Indonesia

Coresponding author: Teta Puji Rahayu (e-mail: tetapuji@poltekkes-surabaya.ac.id)

ABSTRACT Premenstrual Syndrome (PMS) is a common condition affecting adolescent girls, characterized by recurring physical, emotional, and behavioral symptoms that occur in the luteal phase of the menstrual cycle. Several factors, including nutritional status and body fat distribution, are believed to influence the severity of PMS symptoms. One anthropometric indicator that reflects fat distribution is the Waist-to-Hip Ratio (WHR), or Rasio Lingkar Pinggang-Panggul (RLPP), which has been associated with metabolic and reproductive health issues. This study examines the relationship between waist-to-hip ratio (WHR) and premenstrual syndrome (PMS) in adolescent girls. Using a cross-sectional approach and data from 140 respondents, the results showed a significant correlation (p = 0.000) between high WHR and the incidence of moderate to severe PMS. This suggests that central obesity is linked to the severity of PMS symptoms, emphasizing the need for early interventions such as promoting physical activity and healthy diets.

INDEX TERMS waist-to-hip circumference ratio (RLPP); premenstrual syndrome (PMS).

I. INTRODUCTION

Adolescence is a critical period of physical, psychological, and social development, marked by significant biological changes, including the maturation of the reproductive system [1]. One of the most notable changes during this phase is the onset of menstruation (menarche), which signifies entry into reproductive age. Along with these physiological transitions, many adolescent girls begin to experience Premenstrual Syndrome (PMS), a cyclical condition characterized by a variety of physical, emotional, and behavioral symptoms that occur during the luteal phase of the menstrual cycle and subside shortly after menstruation begins [2]. PMS can present with a wide spectrum of symptoms, including abdominal cramps, breast tenderness, fatigue, irritability, anxiety, mood swings, and changes in appetite or sleep patterns [3]. These symptoms can vary in intensity and significantly impact an adolescent's quality of life. Studies have shown that PMS can disrupt concentration, reduce school attendance, impair academic performance, and interfere with daily responsibilities and social relationships. In severe cases, PMS symptoms may resemble premenstrual dysphoric disorder (PMDD), a more intense psychiatric form that requires clinical attention [4].

The global prevalence of PMS among adolescents varies across regions but tends to be higher in developing countries due to limited access to menstrual health education and services [5]. According to a study in Malaysia, 69.7% of adolescent girls were reported to experience PMS, while in Thailand the prevalence was 53%. In Indonesia, data from the Central Statistics Agency indicate that up to 85% of women may experience PMS symptoms, with 60–75% experiencing symptoms of moderate to severe intensity. Local studies also support this finding: a study conducted in East Java reported an increase in PMS prevalence among female adolescents from 62.5% in 2020 to 68.6% in 2021, while research in several high schools showed that 72.2% of female students reported PMS symptoms. The multifactorial etiology of PMS includes hormonal imbalances, neurotransmitter fluctuations (particularly serotonin), genetic predisposition, stress, lifestyle factors, and nutritional deficiencies [3]. One physiological factor that has been increasingly studied is central obesity, which is characterized by excessive fat accumulation around the abdominal area [6]. Central obesity can alter estrogen and progesterone metabolism, increase systemic inflammation, and disrupt insulin sensitivity, all of which may contribute to the development and severity of PMS symptoms [7].

The Waist-to-Hip Ratio (WHR), is a widely used anthropometric indicator of fat distribution [8]. Unlike Body Mass Index (BMI), which does not differentiate between muscle and fat mass or fat location, WHR specifically reflects visceral fat accumulation, which is more metabolically active and has stronger associations with hormonal and reproductive health disorders. According to WHO, a WHR value above 0.85 in females indicates central obesity and is associated with increased risks of cardiovascular disease, type 2 diabetes, and reproductive health problems [9]. Emerging evidence suggests a link between higher WHR and menstrual irregularities, including more severe manifestations of PMS. Central obesity has been associated with elevated levels of pro-inflammatory cytokines and altered estrogen-progesterone ratios, both of which are implicated in PMS pathophysiology [10].

e-ISSN:2808-6422; p-ISSN:2829-3037
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Additionally, unhealthy lifestyle behaviors such as consumption of high sugar and high fat foods, caffeine intake, physical inactivity, and psychological stress may further exacerbate both obesity and PMS symptoms [11].

Despite the biological plausibility of this association, research specifically exploring the relationship between WHR and PMS in Indonesian adolescents remains limited. Given the rising prevalence of both central obesity and PMS among young women, investigating this relationship is critical for the development of effective health interventions. Therefore, this study aims to analyze the relationship between waist-to-hip ratio (WHR) and the severity of premenstrual syndrome in adolescent girls. By understanding this correlation, the study seeks to contribute to the growing literature on adolescent reproductive health and inform the development of targeted health promotion strategies such as nutritional education, weight management, and menstrual health awareness that can be implemented in schools and community settings to improve adolescents' quality of life and academic performance.

II. METHODS

This study used an observational analytical design with a cross-sectional approach to examine the relationship between waist-to-hip ratio (WHR) and premenstrual syndrome (PMS) in adolescent girls. The location of the study was SMAN 1 Barat, Magetan Regency, East Java, Indonesia. The target population consisted of all 211 female students in grade X enrolled in the 2025 academic year. The study sample consisted of 140 female students, determined based on certain inclusion and exclusion criteria. The inclusion criteria included: (1) female students in grade X of SMAN 1 Barat Magetan, (2) who had experienced menstruation, and (3) who were willing to be respondents by signing an informed consent form. The exclusion criteria were: (1) female students who had never experienced menstruation, and/or (2) who were not willing to participate in the study. The sampling technique used simple random sampling through a lottery method. The entire population was given a sequential number, then a lottery process was carried out using a roll of numbered paper to select samples randomly. This method was chosen to reduce the potential for selection bias and increase the representativeness of the sample.

The independent variable in this study was WHR, which is an anthropometric indicator commonly used to assess body fat distribution, especially visceral fat associated with hormonal and metabolic changes, which are thought to be relevant to the onset of PMS symptoms [12]. WHR was calculated by dividing waist circumference by hip circumference. Measurements were taken using a standard measuring tape (Metlin), following WHO guidelines: waist circumference was measured at the midpoint between the bottom of the last palpable rib and the top of the iliac crest, while hip circumference was measured at the widest part of the buttocks. The dependent variable was the severity of PMS symptoms measured using the Shortened Premenstrual Assessment Form (SPAF), a self-report questionnaire that measures physical, psychological, and emotional symptoms that appear before menstruation. Respondents were asked to fill out the SPAF based on their experiences two weeks before their last menstrual period. The Indonesian version of the SPAF has been tested for validity and reliability in adolescent and college student populations. For example, [13] reported a high internal reliability value (Cronbach's $\alpha = 0.84$) in a study of adolescent girls in Tangerang, while [14] obtained similar α values in school adolescents in Java. These results indicate that SPAF is a suitable instrument for use in the context of the Indonesian adolescent population, including students of SMAN 1 Barat Magetan.

Data were analyzed using the Chi-Square test to assess the relationship between WHR categories (normal ≤ 0.85 and high > 0.85, according to the WHO limit for women) and PMS severity (mild, moderate, and severe categories). Prior to analysis, the assumptions of the Chi-Square test such as data independence, minimum sample size, and cell frequency expectations were checked and found to be met. In addition to the p value (with a significance limit of $p < 0.05$), this study also reports the effect size (Cramér's V) and 95% confidence intervals to provide a more comprehensive interpretation of the strength and precision of the observed relationships. All analysis results are presented in tabular form to facilitate interpretation and comparison between groups.

III. RESULTS

A. FREQUENCY DISTRIBUTION OF RESPONDENT CHARACTERISTICS

The characteristics of the general data can be seen in TABLE 1 :

TABLE 1
Frequency Distribution of Respondent Age Characteristics in Grade 10 Students of SMAN 1 Barat Magetan in 2025

Characteristics	Frequency (f)	Percentage (%)
Age		
1. 14 years	3	2.1
2. 15 years	48	34.3
3. 16 years	83	59.3
4. 17 years	6	4.3
Total	140	100

The results of the adolescent age of 140 respondents based on table 4.1 found that 3 students with the age of 14 years (2.1%), 15 years old as many as 48 students (34.3%), 16 years old as many as 83 students (59.3) and 17 years old as many as 6 students (4.3%).

B. WAIST-TO-HIP CIRCUMFERENCE RATIO DISTRIBUTION (WHR)

The specific data in this study consisted of being at risk of PMS and not at risk of PMS. The characteristics of the general data can be seen in TABLE 2:

TABLE 2
Frequency Distribution of Waist-Hip Circumference Ratio (RLPP) in Grade 10 Students of SMAN 1 Barat in 2025

Variable	Frequency (f)	Percentage (%)
Waist Circumference Ratio (RLPP):		
1. No Risk of PMS	107	76.4
2. Risk of PMS	33	23.6
Total	140	100

The results of the RLPP of 140 respondents based on table 4.1, among the 140 respondents, most students had a normal WHR, with 76.4% not at risk for PMS.

e-ISSN:2808-6422; p-ISSN:2829-3037
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C. PREMENSTRAL SYNDROME DISTRIBUTION (PMS)

The specific data in this study consisted of no experience, light, medium and severe. The general characteristics can be seen in TABLE 3:

TABLE 3
Distribution of Frequency of Premenstrual Syndrome (PMS) Incidence in Grade 10 Students of SMAN 1 Barat in 2025

Variable	Frequency (f)	Percentage (%)
PMS:		
1. Not experiencing	0	0
2. Light	66	47.1
3. Keep	66	47.1
4. Heavy	8	5.7
Total	140	100

Of the 140 adolescents studied based on table 4.2, the results were obtained that 66 students each experienced mild and moderate PMS, 8 students experienced severe PMS (5.7%), and those who did not experience PMS were absent.

D. ANALYSIS OF THE RELATIONSHIP BETWEEN RLPP AND STDS

The results of the analysis of the relationship between the Waist-Pelvic Circumference Ratio (RLPP) and Premenstrual Syndrome (PMS) can be seen in table 4:

TABLE 4
The Relationship between Waist-Pelvic Circumference Ratio (RLPP) and Premenstrual Syndrome (PMS) in Grade 10 Students of SMAN 1 Barat in 2025

RLPP		PMS				Sum	*P value*
		Not Experiencing	Light	Keep	Heavy		
No Risk	n	0	65	41	1	107	0,000
	%	0%	60,7%	38,3%	0,9%	100%	
Risk	n	0	1	25	7	33	
	%	0%	3%	75,8%	21,2%	100%	
Sum	n	0	66	66	8	140	
	%	0%	47,1%	47,1%	5,7%	100%	

The results of the study on 140 female adolescents at SMAN 1 Barat based on table 4.3 showed a significant relationship between high WHR and increased severity of PMS on TABLE 4, with 75.8% of students at risk of experiencing moderate PMS and 21.2% severe PMS. To determine the relationship between the waist-hip ratio (WHR) and premenstrual syndrome (PMS) in female adolescents at SMAN 1 Barat, the Chi-Square test was used. In the data analysis, the correlation between WHR and PMS in female adolescents at SMAN 1 Barat obtained a p value of 0.000, indicating that adolescents with higher WHR tend to have more severe PMS symptoms than those with WHR in the normal category.

IV. DISCUSSION

The results showed that most respondents were 16 years old, followed by 15, 17, and 14 years old. This age range corresponds to 10th grade high school students and is included in the late adolescence category (15–18 years), a developmental phase characterized by sexual maturity, stabilization of reproductive hormones, and changes in body composition[15]. Although most adolescents have experienced menarche at the age of 10–14 years, menstrual cycle regularity and hormonal balance are generally achieved in the late adolescence phase. During this period, fluctuations in estrogen and progesterone hormones are still quite high, which can trigger the emergence of premenstrual symptoms [16]. Therefore, a good understanding of the physiological processes during adolescence is very important to support optimal reproductive health management through an educational approach that is appropriate to the development of age and psychosocial needs of adolescents.

In this study, 76.4% of respondents had WHR within normal limits, while 23.6% showed high WHR (≥ 0.85), which reflects central obesity. WHR or waist-to-hip ratio is a standardized indicator to assess body fat distribution, and is considered more informative than body mass index (BMI) in evaluating metabolic risk [17]. High WHR indicates a predominance of visceral fat, which is known to produce inflammatory mediators such as interleukin-6 (IL-6), TNF-α, and CRP. These mediators play a role in disrupting the work of reproductive hormones, affecting the activity of the hypothalamic-pituitary-ovarian (HHO) axis, and causing an imbalance of estrogen and progesterone that worsens PMS symptoms. In addition, abdominal fat accumulation is associated with insulin resistance and serotonin dysregulation, both of which contribute to physical and emotional symptoms of PMS such as breast tenderness, fatigue, mood swings, and depression [18].

In contrast, a normal WHR reflects a more balanced fat distribution, which tends to support hormonal stability and healthy neuroendocrine function [19]. These findings are consistent with the results of previous studies, as reported by [20], that adolescents with low central fat distribution tend to have milder PMS symptoms and a more stable hormonal balance.

The majority of respondents in this study experienced mild to moderate PMS, with only 5.7% reporting severe PMS. This distribution in line study experienced in Jakarta which showed that most adolescents experience PMS in a non-extreme level of severity. PMS symptoms are influenced by multifactorial factors, including fluctuations in sex hormones, neurotransmitter dysregulation such as serotonin and dopamine, and external factors such as psychosocial stress, academic burden, sleep quality, and nutritional status [21]. Deficiencies in important micronutrients such as magnesium, vitamin B6, and calcium have been associated with more severe PMS symptoms. A sedentary lifestyle that is quite common among urban adolescents also exacerbates metabolic and hormonal imbalances [22].

Statistical analysis showed a statistically significant relationship between WHR and PMS severity (p = 0.000). In the group of adolescents with high WHR, 75.8% experienced moderate PMS and 21.2% experienced severe PMS. These data support the hypothesis that central obesity may be a risk factor that worsens PMS symptoms through biological pathways such as systemic inflammation and neuroendocrine dysfunction.

The practical implications of these findings are significant, especially in the context of promotive and preventive efforts in school environments. Early interventions targeting body composition, such as nutrition education programs that emphasize balanced diets, increased regular physical activity such as morning exercise or light sports, and cognitive-based stress management training, can be effective strategies to reduce the prevalence of severe PMS in adolescents [23]. In addition, WHR can be used as a

e-ISSN:2808-6422; p-ISSN:2829-3037
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simple screening tool to detect adolescents at risk of menstrual disorders or metabolic conditions early on [24].

However, this approach must also consider local socioeconomic and cultural factors. Many adolescents in areas such as Magetan Regency may have limited access to nutritious food, sports facilities, and friendly adolescent health services. Cultural factors such as taboos around menstruation, lack of open communication with parents or teachers, and high academic pressure can also worsen PMS [25]. Therefore, interventions must be designed holistically by involving schools, parents, health workers, and considering local social norms and community values.

In conclusion, late adolescence is a critical period of hormonal and physiological development, where body fat distribution as reflected in WHR plays a significant role in determining the severity of PMS symptoms [1]. A multidisciplinary approach combining healthy lifestyle interventions, school-based education, and social support that is sensitive to the local context is needed to improve menstrual health and overall quality of life for adolescent girls [26].

V. CONCLUSION

Based on the results of the study on the relationship between Waist-Hip Ratio (WHR) or WHR with Premenstrual Syndrome (PMS) in 10th grade students at SMAN 1 Barat Magetan, several conclusions can be drawn. The majority of respondents were 16 years old, which is included in the late adolescence stage—a critical period for hormonal development. Most female students had WHR values in the normal category, indicating no direct risk of central obesity. In addition, the incidence of PMS was mostly in the mild and moderate categories. A statistically significant relationship was found between WHR and PMS severity. Female students with higher WHR were more likely to experience moderate to severe PMS symptoms, indicating that central obesity may contribute to hormonal imbalances that affect menstrual health [27]. In conclusion, late adolescence is a critical period in hormonal and physiological development, where body fat distribution as reflected in WHR plays an important role in determining the severity of PMS symptoms. A multidisciplinary approach that combines healthy lifestyle interventions, school-based education, and social support that is sensitive to the local context is needed to improve menstrual health and overall quality of life for adolescent girls [1].

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