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Body Image, Waist Hip Ratio, and Menstrual Cycle in Adolescent Girls at X High School Sidoarjo

Citra Tubuh dan Rasio Lingkar Pinggang Panggul Berhubungan dengan Siklus Menstruasi pada Remaja Putri di SMK X Sidoarjo

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ABSTRACT

Background: In adolescent girls, sexual development is indicated by menarche. The irregular menstrual cycle is a sign of reproductive organ dysfunction. Negative body image and nutritional status are factors that can cause the menstrual cycle to be disrupted due to interference in estrogen hormone production. One of the nutrition status indicators that can be used is waist-hip ratio.
Objectives: To analyzed the association between body image and waist-hip ratio with the menstrual cycle in adolescent girls at X High School Sidoarjo
Methods: This study was conducted with a cross-sectional design. The respondents enrolled in this study were 66 female students in X High School Sidoarjo. Body image data was collected using the Multidimensional Body Self Relation Appearance Scales (MBSRQ-AS) questionnaire, waist-hip ratio (RLPP) was measured with midline, and menstrual cycle was collected with menstrual cycle questionnaire. Data analysis used the Rank-Spearman correlation test.
Results: The analysis showed that the average body image score was 80.4, the waist-hip ratio was 0,75, and the menstrual cycle was 34 days. The analysis also explained a significant association between body image and menstrual cycle (p-value=0.033, r-value=-0.262) and a significant correlation between waist-hip ratio and menstrual cycle (p-value=0.000, r-value=-0.504).
Conclusions: There was a significant correlation between body image and waist-hip ratio with the menstrual cycle in adolescent girls at X High School Sidoarjo.

INTRODUCTION

The adolescent period is known as the second window opportunity due to the growth spurt period. In adolescence, growth and development are marked by changes in physical, sexual, mental, and social. In adolescent girls, menarche is an indicator of sexual development[1]. Typically, menstruation occurs every 28-35 days with a menstrual period of 3-7 days[2]. The menstrual cycle is a clinical marker of a woman's reproductive function[3]. Thus, irregular menstrual cycles are one of the clinical manifestations of polycystic ovary syndrome (PCOS), which is caused by hormonal imbalances that interfere with regular ovulation and are related to obstructions in the fallopian tubes[4]. According to a prior study, the global prevalence of PCOS was about 21.3%[5]. In Indonesia, the prevalence of PCOS was still doubted, but 4-6% of reproductive women were found to have PCOS[6]. Both studies from Deswal et al. and Asghari et al. showed that the prevalence of PCOS increased in the last decade due to genetic and environmental factors [5,7]. Preliminary studies that have been conducted at X High School Sidoarjo showed that 67% of adolescent girls experiencing menstrual cycle disorders.

The irregular menstrual cycle is the clinical manifestation mostly found among PCOS patients (84.2%)[5,8]. Menstrual cycle disorders in adolescents can lead to infertility[9]. Irregular menstrual cycle is divided into some categories, such as amenorrhea, polymenorrhea, and oligomenorrhea[1]. Several risk factors of irregular menstrual cycle are stress and nutritional status[3]. The irregular menstrual cycle has been associated with stress. One of the aspects of stress in adolescence is body image. Young girls are known to evaluate their physical appearance negatively compared to boys[10]. The girls frequently show body and weight dissatisfaction, which is known as negative body image. Negative body image in adolescents is prone to influence their dietary patterns, especially skipping meal habits or weight loss diets in the long term. Those dietary patterns may impact nutritional status. In a prior study conducted

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by Ismayanti (2020), it was found that adolescents with negative body image had a more significant risk of experiencing poor nutritional status[11]. Poor nutritional status may disrupt girls' reproductive ability.

As stated above, nutritional status may become another irregular menstrual cycle risk factor. Nutritional status, primarily obesity, has been correlated with PCOS. According to the location of deposits of fat location, central obesity has been acknowledged to be a better predictor of metabolic disturbance, including hormone imbalance[12]. Increasing fat accumulation in the abdominal area may lead to higher or lower reproductive hormone production that can cause menstrual cycle disorders[13]. Fat accumulation in the abdominal area can be measured by waist-hip ratio (WHR). A study from Kumar et al. indicated that amongst respondents with high-risk WHR (≥ 0.85), 62.5% had disturbance of menstrual cycle[14]. Aiming at this critical concern about infertility risk in adolescents, this study was undertaken to analyze the relationship between the waist-hip ratio and the menstrual cycle in adolescent girls.

METHODS

This study used analytic observational with a cross-sectional design. The population enrolled in this study was 180 female students in X High School Sidoarjo. The number of participants involved was counted with Lemeshow's stratified sampling formula[15]. Based on the Lemeshow formula, 66 girls were required in this study. The inclusion criteria were girls aged 15-18 who had menstruated, physically healthy (able to stand & not have injury in legs), able to read and write, and agreed to join this study respondent. Exclusion criteria were smoking, drinking alcohol, taking hormonal drugs such as regimens, norethinodrel, contraception pills, and having reproductive or hormonal diseases such as PCOS. Girls who met those criteria were given information for consent. Girls who agreed to participate in this study were asked to sign an informed consent sheet.

The instruments in this study include the Multidimensional Body Self Relation Questionnaire Appearance Scales (MBSRQ-AS) questionnaire for body-image data[16,17]. MBSRQ-AS consisted of five aspects: appearance evaluation, appearance orientation, body areas satisfaction scale, overweight preoccupation, and self-classified weight. In this study, participants were asked to complete the MBSRQ-AS questionnaire on their own and divided into two categories based on their MBSRQ-AS score, positive (>75) and negative (≤75)[17]. Waist and hip circumference measurements were done by direct measurement using a midline, while menstrual cycle data was collected by questionnaire. All participants wrote their date of menstruation in the last three months in that questionnaire. The waist-hip ratio was categorized as safe (<0.80) and at-risk (≥0.80)[14]. In contrast, menstrual cycles were classified as normal (21-35 days), polymenorrhea (<21 days), oligomenorrhea (>35 days), and amenorrhea (no menstruation during the last three months consecutively)[18]. Due to abnormal distribution data from the Kolmogorov Smirnov test, the correlation test between variables was carried out by SPSS for Windows 25.0 Spearman Rank test with a significancy level of 0.05. The strength of the correlation was approached with coefficient correlation in the Spearman Rank test. This research has been declared ethically feasible by the Committee of Health Research Ethics, Universitas Nahdlatul Ulama Surabaya, with issued number 282/EC/KEPK/UNUSA/2021.

RESULTS AND DISCUSSION

This study was conducted in February-March 2022 at X High School Sidoarjo. X High School Sidoarjo is a vocational high school located in the urban area of Sekardangan, Sidoarjo, East Java. This school had 607 students, consisting of 427 male students and 180 female students. Based on preliminary studies, there were 67% of 30 female students who had irregular menstrual cycle. Table 1 showed that most participants were 16 and 17 years old, with an average of 16.6±0.90. Using BMI/A, 63.6% of participants had good nutrition (5^{th}-85^{th} percentile), while 18.2% were underweight and 18.2% were overweight/obesity[19]. Almost all of them (88%) had normal waist circumference (<80 cm). Participants had their first menstruation (menarche) at normal age (12-15 years old), as many as 77.3%.

Table 1. Characteristic of Participants

Variable	n	%
Age (years old)		
15	7	10.6
16	25	37.9
17	25	37.9
18	9	13.6
Nutritional Status (BMI/A)		
Underweight (< 5^{th} percentile)	12	18.2
Normal (5^{th} - ≤85^{th} percentile)	42	63.6
Overweight (85^{th} - ≤95^{th} percentile)	9	13.6
Obesity (>95^{th} percentile)	3	4.5
Waist Circumference (cm)		
Safe (<80)	58	88
At-risk (≥80)	8	12
Age of Menarche		
Normal (12-15 years old)	51	77.3
Early (<12 years old)	15	22.7

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Table 2 showed body image, waist-hip ratio, and menstrual cycle among respondents based on its classification. Based on Table 2, it could be seen that the average score of body image measured with MBSRQ-AS was 80.97±7.27. Although most participants had positive body image, 16 participants (24.2%) had negative body image. This result was similar to a previous study that explained there were negative body images in girls aged 15-17 in Yogyakarta[20]. Female students who thought their body shape and appearance were not ideal might be exposed to mass media. Mass media continually defines an ideal body as slim and slender. This was similar to the research of Cahyaningrum et al. (2013), which showed that one of the factors that influence body image is media. Women often exposed to media will compare and pay more attention to their body shape[4]. According to Habibah et al. (2021)., girls who were exposed to the Korean wave in mass or social media had a 2.2 more significant risk of negative body image than girls who were not exposed[20]. In this study, participants were female students aged 15-19 years. Those of that age began to pay attention to body shape or appearance and tended to evaluate their bodies negatively. A prior study conducted by Alidia (2018) explained that the body image scores of male students were higher than female students[21].

Table 1. Body Image, Waist-Hip Ratio, and Menstrual Cycle of Participants

Variable	n (%)	Mean ± SD
Body Image		80.97 ± 7.27
Positif	50 (75.8)	
Negative	16 (24.2)	
Wais-Hip Ratio		0.75 ± 0.05
Safe	59 (89.4)	
At-Risk	7 (10.6)	
Menstrual Cycle		34.6 ± 18.4 (days)
Normal	50 (75.8)	
Polymenorrhea	5 (7.6)	
Oligomenorrhea	6 (9.1)	
Amenorrhea	5 (7.6)	

The waist-hip ratio measurement indicated that over half of the participants in this study were normal, while 10.6% had an at-risk category (Table 2). The average waist-hip ratio was 0.75±0.05. The waist-hip ratio was a fat body distribution parameter; thus, it may indicate central or visceral obesity. Visceral obesity was caused by energy intake exceeding energy expenditure. Excessive energy intake can cause adipose cell hyperplasia and hypertrophy, mainly in the abdomen region[22,23]. Excessive energy intake, including high fat, high glucose, and a high-energy diet, significantly correlated with waist-hip ratio[23]. A previous study also stated that respondents who were centrally obese usually had wrong eating patterns, like consuming fatty foods[24]. Waist-hip ratio ≥0.8 had 1.76 greater risk of degenerative diseases, such as endocrine disorder and cardiovascular disease[25].

Table 2 showed that 24.2% of participants had irregular menstrual cycles, classified into polymenorrhea (menstrual cycle <21 days), 7.6% oligomenorrhea (menstrual cycle >35 days), and amenorrhea (not having menstruation for the last three months). Several factors, such as nutrient intake, body fat percentage, and low physical activity, can cause menstrual cycle irregularities. Deficient or excessive nutrient intake can disrupt reproductive function, contributing to irregular menstrual cycles[24,26]. In addition, inadequate or excessive body fat percentage will cause alteration in estrogen hormone production. Estrogen hormone have an impact on irregular menstrual cycle[27]. Low physical activity also causes irregular menstrual cycles, elevating energy reservation in adipose tissue[28].

Table 3. Correlation between Body Image with Menstrual Cycle

Body Image	Menstrual Cycle								Total		p-value	r
	Normal		Polymenorrhea		Oligomenorrhea		Amenorrhea					
	n	%	n	%	n	%	n	%	n	%		
Positive	38	57.6	5	7.6	3	4.5	4	6.1	50	75.8		
Negative	12	18.2	0	0	3	4.5	1	1.5	16	24.2	0.033*	-0.262
Total	50	75.8	5	7.6	6	9.1	5	7.6	66	100		

*p-value <0.05

Based on Table 3, there was a significant association between body image and the menstrual cycle, with a p-value of 0.033 and r-value of -0.262. The r-value showed a negative association, indicating lower body image associated with longer menstrual cycles. Body image was an indirect cause of menstrual cycle disorders. Body image was related to stress level; therefore, stress can cause menstrual cycles to be disrupted. According to Annarahayu et al. (2021), stress may elevate the production of the primary mediator of the stress system in the ovaries, endometrium, and hypothalamus, which may disturb gonadotrophin-

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releasing hormone (GnRH) secretion. This decrease in GnRH secretion then affects the decline of ovulation, and it may disrupt luteinizing hormone, estrogen, and progesterone levels. That mechanism resulted in an irregular menstrual cycle[3,29]. This study had a similar result to Yuliana (2021), which showed a relationship between stress levels and menstrual cycle disorders[30]. A previous study also showed that the higher stress level in a woman might cause a surge and imbalance of reproductive hormones in the body, which results in a shorter or longer menstrual cycle[29]. Besides stress, body image also will affect an individual's dietary intake. A study conducted by Krohmer et al. (2019) explained that negative body image was an important factor for eating disorders[31]. Individuals with body dissatisfaction are prone to reducing their dietary intake; thus, it may impact poor nutritional status. In line with research conducted by Islamy & Farida (2019), nutritional status related to body image was a risk factor for menstrual cycle irregularities[27]. Poor nutritional status may lead to a decline in gonadotropin-releasing hormone secreted by follicle-stimulating and luteinizing hormones, resulting in decreased estrogen levels. The decrease in estrogen levels will affect ovulation and the menstrual cycle[30].

The Spearman Rank test analyzed the correlation between the waist-hip ratio and the menstrual cycle. Table 4 showed that there was a correlation between waist-hip ratio and menstrual cycle (p-value <0.01) with a negative correlation (r-value -0.504). The direction of the r-value means that the greater the waist-hip ratio, the shorter the menstrual cycle.

Table 4. Correlation between Waist-Hip Ratio with Menstrual Cycle

Waist-Hip Ratio	Menstrual Cycle								Total		p-value	r
	Normal		Polymenorrhea		Oligomenorrhea		Amenorrhea					
	n	%	n	%	n	%	n	%	n	%		
Safe	46	69.7	2	3.1	6	9.1	5	7.6	59	89.4		
At-Risk	4	6.1	3	4.5	0	0	0	0	7	10.6	0.000*	-0.504
Total	50	75.7	5	7.6	6	9.1	5	7.6	66	100		

*p-value <0.05

As explained above, the waist-hip ratio was an indicator of central obesity. A recent study showed similar results to several studies that have shown that women with obesity were more prone to menstrual cycle irregularity than non-obese women[32]. Participants who had a risk waist-hip ratio were experiencing polymenorrhea due to high-fat accumulation in the abdominal area. High-fat accumulation in the abdominal area would cause fatty tissue to produce more elevated estrogen hormones, disrupting menstrual cycles[33]. According to Kumar et al. (2018), there was a relationship between the waist-hip ratio and the menstrual cycle (p=0.02)[14]. Similar to Andriani (2018), it was found that students who had central obesity also had menstrual cycle irregularities[34]. Central obesity had an association with adiponectin levels produced by adipose tissue. Excessive adipose tissue may decrease adiponectin levels, along with increased inflammatory cytokines, like interleukin-6 (IL-6), C-reactive protein (CRP), and tumor necrosis factor-alpha (TNF-α). Those inflammatory markers cause inflammation in the hypothalamus and lead to insulin resistance. Insulin resistance promotes luteinizing hormone (LH) activity and releases androgen from the ovary[35]. Hyperandrogenism is statistically associated with amenorrhea or oligomenorrhea[32]. Insulin resistance also stimulates the activity of the follicle-stimulating hormone (FSH); therefore, secretion of the follicle-stimulating hormone might be inhibited, causing irregularity in the menstrual cycle[33,36].

This study has several limitations which should be considered in further study. This study did not examine stress levels and hormone levels, such as insulin, estrogen, androgen, follicle-stimulating hormone, and luteinizing hormone. Those hormones may mediate the relationship between body image, waist-hip ratio, and menstrual cycle. This study also used a self-administered questionnaire for menstrual cycle data; thus, it may be prone to error. A further study with repeated measurement of nutritional status indicators, dietary intake, and other risk factors of irregular menstrual cycles was needed to identify the causal relationship between menstrual disorder and lifestyle in adolescents.

CONCLUSIONS

The present study concluded a significant relationship between body image and menstrual cycle. There was also a significant relationship between waist-hip ratio and menstrual cycle in adolescent girls.

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Conflict of Interest and Funding Disclosure

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