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The Relationship Between Body Mass Index and Waist-to-Hip Ratio on Menstrual Cycle in Female Cadets of Cohort 4, Republic of Indonesia Defense University

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Abstract

Background: Women's reproductive health may be influenced by anthropometric factors, including body mass index (BMI) and waist-to-hip ratio (WHR). Menstrual-cycle disorders are common in adolescent and young adult women and may be associated with nutritional status, central adiposity, hormonal imbalance, and lifestyle factors. This study aimed to analyze the relationship between BMI and WHR with menstrual cycle patterns among female cadets of Cohort 4 at the Republic of Indonesia Defense University. **Methods:** This observational analytic study used a quantitative cross-sectional design. Female cadets meeting the inclusion and exclusion criteria were recruited. Anthropometric measurements were performed to calculate BMI and WHR. Menstrual-cycle data were collected using a structured questionnaire and categorized as normal or abnormal. Fisher's exact test was used to evaluate the relationship between BMI and menstrual cycle and between WHR and menstrual cycle with a significance level of $p<0.05$. **Results:** A total of 55 female cadets were included. Most respondents had normal BMI (78.2%), while 60.0% had WHR classified as at risk. Fisher's exact test showed no significant association between BMI and menstrual cycle ($p=0.164$), whereas WHR was significantly associated with menstrual cycle pattern ($p=0.000$). **Conclusion:** BMI was not significantly associated with the menstrual cycle among female cadets, but WHR showed a significant relationship. Interventions focusing on healthy nutritional status, ideal fat distribution, and physical activity may support reproductive health in female cadets.

Keywords: *body mass index; waist-to-hip ratio; menstrual cycle; reproductive health; female cadets..*

Background

Puberty is accompanied by reproductive hormonal changes, particularly estrogen and progesterone, leading to the maturation of reproductive organs and the onset of menarche. Menstrual-cycle disturbances such as irregular, prolonged, or shortened cycles are common among adolescent girls and young women.[1,2]

BMI is widely used as an indicator of nutritional status and is calculated by dividing body weight in kilograms by the square of height in meters.[3] Abnormal BMI has been associated with hormonal disturbances and menstrual irregularities in several populations, although findings remain inconsistent.[4-7]

Waist-to-hip ratio (WHR), also referred to as RLPP, is used to assess central adiposity. Increased abdominal fat can influence estrogen, progesterone, follicle-stimulating hormone, and luteinizing hormone balance, which may contribute to oligomenorrhea, polymenorrhea, dysmenorrhea, or other menstrual abnormalities.[8-10] This study was conducted to determine whether BMI and WHR are associated with menstrual-cycle patterns among female cadets at the Republic of Indonesia Defense University.

Methods

Study design and setting

This was an observational analytic study with a quantitative cross-sectional design. The study was conducted at the Republic of Indonesia Defense

University, IPSC Sentul Area, Sukahati, Citeureup District, Bogor Regency. Socialization and informed consent were conducted on August 18, 2024. Ethical clearance was approved on August 11, 2024, with reference number 24-08-028. Data collection began on September 14, 2024, and lasted for one week.

Participants

The study population consisted of Cohort 4 female cadets of the Republic of Indonesia Defense University for the 2024/2025 academic year. Inclusion criteria were female cadets aged 18 years or older, willingness to participate, and being physically and mentally healthy. Exclusion criteria were chronic disease, especially reproductive-system disorders; current use of hormonal medications and a previous history of reproductive treatment.

Data collection

Body weight and height were measured to calculate BMI, which was categorized as underweight, normal, or overweight. WHR was measured using a measuring tape and classified as at risk if WHR was ≥0.80 and normal if WHR was <0.80. Menstrual-cycle data were obtained using a questionnaire and categorized as normal or abnormal.

Statistical analysis

Fisher's exact test was used to analyze the relationship between BMI and menstrual cycle and between WHR and menstrual cycle because the variables were categorical. A p-value <0.05 was considered statistically significant.

Results

A total of 55 female cadets were included. The respondents were predominantly 19 years old (50.9%). Most respondents had menarche at 9–11 years (72.7%), height 151–160 cm (50.9%), body weight 56–65 kg (45.5%), normal BMI (78.2%), and WHR classified as at risk (60.0%).

Table 1. Distribution of respondents by demographic and anthropometric characteristics.

Characteristic	Frequency (N)	Percentage (%)
Age 18 years	12	21.8
Age 19 years	28	50.9
Age 20 years	15	27.3
Menarche 9-11 years	7	12.8
Menarche 12-14 years	40	72.7
Menarche 15-17 years	8	14.5
Height 141-150 cm	1	1.8
Height 151-160 cm	28	50.9
Height 161-170 cm	26	47.3
Weight 46-55 kg	1	1.8
Weight 56-65 kg	22	40.0
Weight 66-75 kg	25	45.5
Weight >75 kg	6	10.9
BMI underweight	2	3.6
BMI normal	43	78.2
BMI overweight	10	18.2
WHR at risk	33	60.0
WHR normal	22	40.0

Table 2. Distribution of respondents according to BMI, WHR, and menstrual-cycle category.

Variable	Category	N	%
BMI	Underweight	2	3.6
BMI	Normal	43	78.2
BMI	Overweight	10	18.2
WHR	At risk	33	60.0
WHR	Normal	22	40.0
Menstrual cycle	Polymenorrhea	28	50.9
Menstrual cycle	Normal	23	41.8
Menstrual cycle	Oligomenorrhea	4	7.3

Table 3. Distribution of respondents according to menstrual cycle and BMI.

BMI	Polymenorrhea N (%)	Normal N (%)	Oligomenorrhea N (%)	Total N (%)	p-value	Cramer V
Underweight	1 (1.8)	0 (0.0)	1 (1.8)	2 (3.6)	0.164	0.360
Normal	21 (38.2)	20 (36.4)	2 (3.6)	43 (78.2)		
Overweight	6 (10.9)	3 (5.4)	1 (1.8)	10 (17.3)		
Total	28 (50.1)	23 (41.8)	4 (7.2)	55 (100)		

Table 4. Cross-tabulation of WHR with menstrual cycle among female cadets.

WHR	Polymenorrhea N (%)	Normal N (%)	Oligomenorrhea N (%)	Total N (%)	p-value	Cramer V
At risk	24 (43.6)	5 (9.1)	4 (7.3)	33 (60.0)	0.000	0.666
Normal	4 (7.3)	18 (32.7)	0 (0.0)	22 (40.0)		
Total	28 (50.9)	23 (41.8)	4 (7.3)	55 (100)		

Discussion

This study showed that BMI was not significantly associated with menstrual-cycle pattern among female cadets. Most participants had normal BMI, and the limited variation in BMI categories may have reduced the ability to detect a significant relationship. Previous studies have reported mixed findings, with some showing associations between abnormal BMI and

menstrual irregularities, while others reported no significant relationship.[4-7,11]

In contrast, WHR showed a significant association with menstrual-cycle pattern. Central adiposity may be more closely linked to reproductive hormonal regulation than BMI alone because WHR reflects abdominal fat distribution and metabolic risk. Increased central adiposity may alter estrogen metabolism, insulin resistance, and hypothalamic-pituitary-ovarian axis regulation, thereby contributing to menstrual irregularities.[8-10,12]

Although the cadet population is expected to have regular physical activity, differences in fat distribution, dietary patterns, stress, sleep, and individual metabolic profiles may still influence reproductive health. Therefore, WHR assessment may be useful as an additional anthropometric screening tool in female cadets.

Conclusion

Among female cadets of Cohort 4 at the Republic of Indonesia Defense University, BMI was not significantly associated with menstrual-cycle pattern, whereas WHR was significantly associated with menstrual-cycle pattern. Maintenance of healthy nutritional status, ideal fat distribution, and regular physical activity should be encouraged to support optimal reproductive health.

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Author Contributions

TN contributed to study preparation, data collection, and manuscript drafting. EF, FE, SP, and AS contributed to supervision, methodological review, data interpretation, and manuscript revision. All authors approved the final manuscript.

Conflict of Interest

The authors declare no conflict of interest.

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