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Correlation of macronutrient intake and body fat precentage with menstrual cycle

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ABSTRAK

Latar Belakang: *Hasil Riset Kesehatan Dasar Tahun 2010 menyatakan bahwa terdapat sebanyak 13,7% wanita di Indonesia mengalami siklus menstruasi tidak teratur, 7,7% disebabkan oleh faktor pola hidup. Sumatera Barat merupakan provinsi tiga tertinggi gangguan siklus menstruasi di Indonesia, dengan prevalensi sebesar 19,1% (3).*
Tujuan: *Penelitian ini bertujuan untuk mengetahui hubungan antara jumlah asupan makronutrien dan kadar lemak tubuh dengan siklus menstruasi pada mahasiswi Fakultas Kedokteran Universitas Andalas.*
Metode: *Penelitian ini merupakan penelitian observasional dengan desain penelitian cross sectional. Penelitian ini dilaksanakan di Fakultas Kedokteran Universitas Andalas pada bulan November 2021-September 2022, dengan jumlah sampel sebanyak 78 orang. Sampel diperoleh secara sistematis berdasarkan interval sampel. Pengumpulan data dilakukan secara langsung dengan cara pemeriksaan fisik dan pengisian kuesioner. Analisis bivariat dilakukan dengan uji t-independen dan analisis multivariat dilakukan dengan regresi logistik.*
Hasil: *Hasil penelitian menyatakan bahwa 42,3% mahasiswi memiliki siklus menstruasi tidak normal, rerata jumlah asupan makronutrien (kalori total, karbohidrat, lemak, protein) dan kadar lemak tubuh mahasiswi adalah 2725,40±269,90 kkal, 378,86±40,70 gram, 90,58±14,40 gram, 98,54±11,36 gram, dan 36,19±7,02%. Uji T-independen menunjukkan bahwa terdapat hubungan yang bermakna antara jumlah asupan makronutrien (kalori total, karbohidrat, lemak, protein) dan kadar lemak tubuh dengan siklus menstruasi (p=0,000, 0,016, 0,005, 0,028, 0,000). Uji regresi logistik menunjukkan bahwa kadar lemak tubuh merupakan faktor yang paling dominan berhubungan dengan siklus menstruasi (p=0,000).*
Kesimpulan: *Adanya hubungan yang bermakna antara jumlah asupan makonutrien dan kadar lemak tubuh dengan siklus mentruasi. Serta, kadar lemak tubuh merupakan faktor yang paling dominan berhubungan dengan siklus menstruasi.*

KATA KUNCI: *asupan makronutrien; kadar lemak tubuh; siklus menstruasi*

ABSTRACT

Background: *Indonesian Basic Health Research 2010 state that 13.7% of women in Indonesia with irregular menstrual cycles, 7.7% caused by lifestyle factors. West Sumatra is third highest province of irregular menstruation prevalence in Indonesia, which is 19.1% (3).*

Objectives: *The purpose of this research is to determine the relationship between macronutrient intake and body fat percentage with the menstrual cycle in female students Faculty of Medicine, Andalas University.*
Methods: *This research type was an observational study with cross sectional research design. This research was conducted at the Faculty of Medicine, Andalas University in November 2021-September 2022, with samples were 78 respondents. Samples were taken systematically based on sample intervals. Data were collected by physical examination and questionnaires. Bivariate analysis used independent sample t-test and multivariate analysis used logistic regression.*
Results: *The results of this research stated that 42.3% of respondents had irregular menstruation, the mean of macronutrient intake (calories, carbohydrate, fat, protein) and body fat precentage of respondents were 2725.40±269.90 kcal, 378.86±40.70 gram, 90.58±14.40 gram, 98.54±11.36 gram, and 36.19±7.02%. The independent sample T-test showed that a significant relationship between of macronutrient intake (calories, carbohydrate, fat, protein) and body fat percentage with menstrual cycle (p=0.000, 0.016, 0.005, 0.028, and 0.000). The logistic regression test showed that body fat precentage as dominant factor of menstrual cycle (p=0.000).*
Conclusions*: The conclusion of this research is a significant relationship between macronutrient intake and body fat percentage with the menstrual cycle. And also, body fat percentage as dominant factor of menstrual cycle.*

KEYWORD: *body fat percentage; macronutrients intake; menstrual cycle*

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INTRODUCTION

Preconception women are in the age range of 20-29 years. As to be a mothers, women preconception is a vulnerable group that needs special attention regarding their health status, especially reproductive health. The main characteristic of women preconception is development for better of reproductive organ functions, so that peak fertility is achieved (1).

The menstrual cycle is considered normal period of 21-35 days (1). In general, intervals of menstruation cyles between 21-35 days, menstruation lasts for 4-6 days and the normal volume of blood that comes out is 30 ml % (2). Based on the results of Indonesian Basic Health Research 2010 stated that as 13.7% of women in Indonesia with irregular menstrual cycles, 7.7% caused by lifestyle factors. West Sumatra is third highest prevalence of irregular menstruation in Indonesia, which is 19.1% (3).

Irregular menstruation are caused by several factors, including: genetics, race, age, abnormality of reproductive organ, diseases, and hormonal factors, such as: contraception, obesity, and stress (1). Irregular menstruation in obese women are caused by increased levels of steroid hormones, where the hormone estrogen is not only produced in the ovarium, but is also produced from accumulated of fat in the tissues (4),(5).

The lifestyle of young women is very important to created healthy menstruation, which one is related to nutritional intake (6). In addition, based on the results of Indonesian Basic Health Research 2010, it is known that the reason a woman aged 20-24 years in Indonesia experienced irregular menstruation is use of contraception (6%), diseases and abnormality of reproductive organs (0.7%), and lifestyle factors (7.7%) (3). Taheri et al. (2020) stated that the significant relationship between higher of intake calori, carbohydrate, fat, and protein with irregular menstruation, menstrual pain and PMS (6). The purpose of this research is to determine

correlation between macronutrient intake and body fat percentage with the menstrual cycle in female students Faculty of Medicine, Andalas University.

MATERIAL AND METHODS

This research type was observational study with a cross sectional research design. This research was conducted at the Faculty of Medicine, Andalas University in June-July 2022, with sample amounted to 78 undergraduate female students of the Medical Education Study Program, Faculty of Medicine, Andalas University 2020/2021 and 2021/2022. Samples were taken systematically based on sample intervals from medical check-up (MCU) data undergraduate female students of the Medical Education Study Program, Faculty of Medicine, Andalas University 2020/2021 and 2021/2022 at Andalas University Hospital. Sample intervals obtained from total population of undergraduate female students of the Medical Education Study Program, Faculty of Medicine, Andalas University 2020/2021 and 2021/2022 (252 persons) devided sample size (78 persons).

Data of macronutrient intake were obtained directly from interview with respondents using SQ-FFQ. Data of menstrual cycle were obtained directly from interview with respondents using menstrual cycle questionnaire. Menstrual cycles was categorized normal if it occurs on 24-38 days and it was irregular if it occurs on <24 days or >38 days (2). And also, data of body fat precentage was collected from physical examination by using Bioelectrical Impendance Analysis (BIA) method. Data of this research were homogen and normally distributed by normality test and homogenity test with Levene's test and Kolmogorov-Smirnov test. Bivariate analysis used independent sample t-test. Multivariate analysis used logistic regression. This research was approved by the Health Medical Research Ethics Committee at the Faculty of Medicine, Andalas University (Sumatera Barat, Indonesia) with regristration number 675/UN.16.2/KEP-FK/2022.

RESULT AND DISCUSSION

General Description of Respondents

Table 1. Partisipant's characteristic based on age, waist circumference, hip circumference, and body mass index (BMI)

Variable	*Mean* ± SD
Age (years old)	19.82±0.879
Waist Circumference (cm)	78.47±10.06
Hip Circumference (cm)	98.22±11.29
BMI (kg/m^2)	25.07±5.05

This research included 78 respondents. Data on characteristics of respondents can be seen in **Table 1**. Results this research in Table 1 showed that respondents who participated in this research were aged 19-20 years. There was included in women preconception because there age was at the range of age 20-29 years. women preconception is a vulnerable group that needs special attention regarding their health status, especially reproductive health because characteristic of women preconception is menstruation and the development for better of reproductive organ functions, so that peak fertility is achieved (1).

The mean waist circumference and hip circumference of female students were 78.47 ± 10.06 cm and 98.22 ± 11.29 cm. This results illustrated accumulation of body fat in the waist and hips. The accumulation of fat in body tissues caused extraovarian steroidogenesis. Aromatase (CYP19A1) in adipocytes is responsible aromatization of androstenedione, and then increasing level of estradiol in the blood. It would be negative feed back of secretion of FSH in hypothalamus, thus caused anovulatory cycles (5). Taheri et al, (2020) stated that women with irregular menstruation have a larger waist circumference compared to women with normal menstruation (p-value <0.001) (6). Female students have mean of BMI were 25.07±5.05 kg/m2. This is showed that female students were obesity (BMI ≥25 kg/m2) (7). Moini et al, (2020) stated that women with obesity have abnormal menstrual cycles, abnormal bleeding, and pain during menstruation (4).

Table 2. Frequency distribution of respondents based on menstrual cycle

Menstrual Cycle	f	%
Irregular	33	42.3
Normal	45	57.7
Total	78	100

Based on **Table 2**, we can showed that almost half of female students (42.3%) have irregular menstruation. Indonesian Basic Health Research 2010 state that 13.7% of women in Indonesia with irregular menstrual cycles, 7,7% caused by lifestyle factors. West Sumatra is third highest province of irregular menstruation prevalence in Indonesia, which is 19.1%. (1). Results of this research related to research at Faculty of Medecine, Shiraz University, bercause female students with menstrual cycle disorders were characterised by significantly higher BMI, 41 (65.1%) were overweight and 34 (82.9%) were obesity (6).

Univariate Analysis

Table 3. Macronutrient intake

Variable	*Mean* ± SD
Calories (kkal)	2725.40 ± 269.90
Carbohydrate (g)	378.86 ± 40.70
Fat (g)	90.58 ± 14.40
Protein (g)	98.54 ± 11.36

Regulation of the Minister of Health of the Republic of Indonesia 2019 number 28 recommended amount of daily macronutrient intake (calories, carbohydrates, fat, and protein) for Indonesian women at aged 20-29 years old is 2250 kcal, 360 gram, 65 gram, and 60 gram (8). But, at this research showed that macronutrient intake (calories, carbohydrates, fat, and protein) of female students with irregular menstruation were 2725.40±269.90 kcal, 378.86±40.70 gram, 90.58±14.40 gram, and 98.54±11.36 gram. This is illustrated most female students at the Faculty of Medicine, Andalas University were higher macronutrients intake.

This result was higher than the results of a study on women aged 19-25 years at the Faculty of Nutrition, University of Poznan, Poland, because macronutrient intake (energy, carbohydrate, fat and protein) of female students with menstrual cycle disorders were 1942±167 kcal, 263±44.9 gram, 76.4±26.6 gram, and 84.4±14.3 gram, and female students with normal menstruation only were 1531 ± 339 kcal, 212 ± 52 gram, 54.1 ± 14.2 gram, 69.4 ± 17.2 gram (9). Taheri et al, (2020) found the same result, macronutrient intake consumed by female students with irregular menstruation higher than normal menstruation (p-value <0.001) (6).

Wahyuni and Dewi (2018) found different results in a study at Semarang, they showed that macronutrient intake except protein in women with normal menstruation was higher than women with menstrual cycle disorders because people in Semarang usually consumed low fat diets (10). Food patterns are influenced by two factors, external factors and internal factors. Socioeconomic, education, culture, and access of food are external factors would be influenced person's food pattern (1). Socioeconomic status is closely related to the quality and quantity of food consumed because person's income would be impacted food and the variety of dishes. If increasing of person's income, the type amount and of food consumed will be increased and improved. Furthermore, socioeconomic status was related to prevalence of obesity and any problem (1).

Table 4. Body fat precentage

Variable	*Mean* ± SD
Body Fat Precentage (%)	36.19 ± 7.02

Based on **Table 4**, it can be seen that the mean of body fat percentage of female students with irregular menstruation was 36.19±7,02%. Prediction of body fat pracentage in asian women aged 20-39 years is 25% (BMI<18.5 Kg/m2), 35% (BMI≥25 Kg/m2), and 40% (BMI≥30 Kg/m2) (11). Therefore, this research illustrated that female students most female students at the Faculty of Medicine, Andalas University were obese because their had higher of body fat precentage.

Andrea et al, (2021) stated that significant association between body fat precentage and

menstrual disorders, who had menstrual disorders was higher body fat precentage. 44.3% of women with menstrual cycle disorders, 38.7%-53,5% of women was oligomenorrhea and 73% of them were central obesity (12).

This results are different from research conducted by Wahyuni and Dewi (2018) in Semarang, where the results showed that the mean of body fat precentage in women with menstrual disorders was lower than in women with normal menstrual cycles, which was 22.46±4.8% in women with menstrual cycle disorders and 24.30±3.6% in women whose menstrual cycles are normal, because the majority of respondents in the study were in normal BMI (10).

Bivariate Analysis

Table 5. Correlation between macronutrient intake with menstrual cycle

Macronutrient Intake	Menstrual Cycle		p-value
	Irregular (n=33)	Normal (n=45)	
	***Mean* ± SD**	***Mean* ± SD**	
Calories (kkal)	2839.87±229.32	2644.82±226.85	0.000
Carbohydrate (g)	391.58 ±37.70	369.31±40.40	0.016
Fat (g)	95.87±12.90	86.69±14.32	0.005
Protein (g)	102.66±11.81	96.85±10.95	0.028

Bivariate analysis with independent sample T-test

Based on **Table** 5, we can be seen that significantly relationship between macronutrient intake (calories, carbohydrate, fat, and protein) with menstrual cycle (p-value: 0.000, 0.016, 0.005, and 0.028). The lifestyle of young women is very important to created healthy menstruation, which one is related to nutritional intake, because irregular menstruation, painful menstruation, and PMS were significantly associated with high intake of calories, carbohydrate, fat, and protein (6).

Kazmierczak et al, (2017) stated that there were differences in food intake patterns between of women who normal and irregular menstruation. Women with menstrual cycle disorders consumed significantly more animal protein and less protein of plant origin. In addition, the total consumption of total fat and saturated fatty acids is higher in women aged 19-25 years who irregular menstruation compare to normal menstruation (9). This results are different from research conducted by Hanapi, et al (2020) at Faculty Medicine, Gorontalo University, there study was not found significantly relationship between macronutrient intake: protein, fat, and carbohydrate with menstrual cycle (13).

Increasing carbohydrate intake will be caused hiperinsulinemia. Increased levels of insulin and Insulin Growth Factors tipe 1 (IGF-1) can inhibited the synthesis of Sex Hormone Binding Globulin (SHBG) (7). SHBG is a glycoprotein, there is functions as an intermediary for the response of gonadotropin hormones Follicle Stimulating Hormone (FSH) and Luteinizing Hormone (LH) to target cells so that estrogen and progesterone can be produced in the ovarian. Therefore, conditions like this can lead to increased production of androgen hormone (hyperandrogenism) and decreased secretion of the progesterone, which in turn can cause anovulatory cycles. This syndrome is called PCOS (14). However, if energy intake is reduced for a certain period of time, it will cause a decrease of LH secretion (15).

Table 6. Correlation between body fat precentage with menstrual cycle

Variable	Menstrual Cycle		p-value
	Irregular (n=33)	Normal (n=45)	
	Mean ± SD	*Mean* ± SD	
Body fat precentage (%)	42.71±4.42	31.66±444	0.000

Bivariate analysis with independent sample T-test

Results of this research showed that a significantly relationship between body fat levels and the menstrual cycle with p-value = 0.000 (p≤0.05) (**Table 6**). Andrea et al, (2021) stated that women with higher of body fat percentage has been high risk of menstrual cycle disturbances (12). This is related with a study by Young et al, (2021) on women in Korea, there are women with normal BMI, 93% normal menstruation (21-35 days), 95.2% have a normal menstrual cycle period (2-7 days), and 55.9% have normal bleeding. Meanwhile, in women with overweight or obesity, 25.5% Premenstrual Syndrome (PMS) and 5.2% Polycystic Ovary Syndrome (PCOS) (16).

Prathita et al, (2017) found different results in a study conducted on female students at the Faculty of Medicine, Andalas University, Padang, which found that there was no significant relationship between BMI and body fat percentage with menstrual cycle because the majority of respondents are in normal BMI (17). Imbalance between of energy intake and energy expenditure can caused accumulation body fat in body tissues (18). Accumulation of body fat in body tissues impact to increasing secretion of estrogen (4). Adipocytes had aromatization P450, it will convert cholesterol to steroid hormone (estrone), and then estrone become estradiol with help of 17β-Hydroxysteroid Dehydrogenases type 1 (17-βHSD1). Therefore, women with obesity and women with normal BMI has difference of estrogen level, and then impact to her menstrual cycles (5).

Imbalance between of energy intake and energy expenditure can caused accumulation body fat in body tissues. In addition, will be any problems and diseases. Therefore, high consumption of macronutrient intake should be balanced with physical activity. However, therefore, high consumption of macronutrient intake should be balanced with physical activity. However, in this time there was a change in lifestyle at younger generation towards a modern lifestyle, such as increasing of used transportation in daily activities, so as to reduce physical activity (18). This condition also occurs in Padang, where as much as 55.12% of the people are categorized lack of physical activity (19).

Researchers assumed that female students with irregular menstruation have high of body fat precentage compare to female students with normal menstruation because majority were obesity. Researchers assumed that female students with irregular menstruation have high of body fat precentage compare to female students with normal menstruation because majority were obesity. In addition, the high of learning activity in the room and using transportation goes to campus can limited physical activity. However, this study has not examined physical activity of female students as a whole.

Multivariate Analysis

Table 7. Regression logistic results

Variable	p-*value*	B	CI 95%
Body fat precentage (%)	0.000	-0.46	0.52-0.77

Based on **Table 7**, it can be seen that body fat percentage as dominant factor of menstrual cycle in female students of the Faculty of Medicine, Andalas University (p-value <0.001). This results has correlation that leads to negative probability (-0.461), if female students has body fat precentage is not high, then she will have been a normal menstrual cycles.

Imbalance between of energy intake and energy expenditure can caused accumulation body fat in body tissues (17). Accumulation of body fat in body tissues impact to increasing secretion of estrogen (4). Adipocytes had aromatization P450, it will convert cholesterol to steroid hormone (estrone), and then estrone become estradiol with help of 17β-Hydroxysteroid Dehydrogenases tipe 1 (17-βHSD1). Therefore, women with obesity and women with normal BMI has difference of estrogen level, and then impact to her menstrual cycles (5). Results of this research stated that the mean of respondents was obesity. Beside that higher of consuming macronutient intake and lack of physical activities impact to accumulation body fat in body tissues, and then caused the female students has menstrual cycles disturbance.

CONCLUSIONS AND RECOMMENDATION

Increasing of macronutrient intake consumed by women and higher of body fat precentage would be impact to her menstrual cycle. In fact, body fat percentage as dominant factor of menstrual cycle. So, women preconception must be doing healthy lifestyle and health screenings routine, especially about reproductive health. And also, the government should cooperate with universities about reproductive health screenings and expected the next research about any life style factors correlate with menstrual cycle, such as: stress and physical activity.

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