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Correlation of macronutrient intake and body fat precentage with menstrual cycle in famale students faculty of medicine Andalas University

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ABSTRACT

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%.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. 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-September2022, with samples were 78 respondents. Sample techniques used systematic random sampling. Data were collected by physical examination and questionnaires. Bivariate analysis used independent sample t-test and multivariate analysis used logistic regression. The results of this research stated that the mean of macronutrient intake (calories, carbohydrates, fat, and protein) consumed by female students with irregular menstruation were 2839,87±229,32 kcal, 391,58±37,70 gram, 95,87±12,90 gram, 102,66±11,81 gram, and 42,71±4,42%. In addition, female students with normal menstruation were 2644,82±226,85 kcal, 369,31±40,40 gram, 86,69±14,32 gram, 96,85±10,95 gram, and 31,66±4,44%. This research showed that female students with irregular menstruation had higher of macronutrient intake and body fat percentage (p-value = <0.001, 0.016, 0.005, 0.028, and <0.001). The conclusion of this research is a significant relationship between macronutrient intake and body fat percentage with the 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 (Dieny, *et al*., 2019).

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 % (Astarto, *et al*., 2011). 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% (Ministry of Health of the Republic of Indonesia, 2010).

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 (Dieny, *et al*., 2019). 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 (Moini, *et al*., 2020; Sholmo, *et al*., 2011).

The lifestyle of young women is very important to created healthy menstruation, which one is related to nutritional intake (Taheri, *et al*., 2020). 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%) (Ministry of Health of the Republic of Indonesia, 2010). 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 (Taheri, *et al*., 2020). The previous research was described about relationship between higher of macronutrient intake with irregular menstruation or relationship between higher of body fat precentage with irregular menstruation was separetly. But, In this research these variables was combined. So, 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 with using a cross sectional research design.

RESEARCH METHOD

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. Sampling technique used systematic random sampling. Data of macronutrient intake and menstrual cycle were obtained directly from interview with respondents using SQ-FFQ and menstrual cycle questionnaire. And also, data of body fat precentage was collected from physical examination by using *Bioelectrical Impendance Analysis* (BIA) method.

This research was a quantitative study This research aims to determine correlation macronutrient intake and body fat precentage with menstrual cycle. 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.

RESULTS AND DISCUSSIONS

Univariate Analysis

Univariate analaysis used data of macronutrient intake, menstrual cycle and body fat precentage were collected by SQ-FFQ, menstrual cycle's questionnaires, and BIA measurements. Then, this data was computerized (SPSS.16 version) to describe about macronutrient intake, body fat precentage, and menstrual cycles of Female Students Medical Education Study Program, Faculty of Medicine, Andalas University 2020/2021 and 2021/2022.

Table 1. Macronutrient intake of Female Students Medical Education Study Program, Faculty of Medicine, Andalas University 2020/2021 and 2021/2022

Variable	Menstrual Cycle	
	Irregular (n =33)	Normal (n = 45)
	Mean ± SD	*Mean* ± SD
Calories (kcal)	2839,87±229,32	2644,82±226,85
Carbohydrate (g)	391,58±37,70	369,31±40,40
Fat (g)	95,87±12,90	86,69±14,32
Protein (g)	102,66±11,81	96,85±10,95

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 grams, 65 grams, and 60 grams% (Ministry of Health of the Republic of Indonesia, 2019). But, at this research showed that macronutrient intake of female students with irregular menstruation were 2839.87±229.32 kcal, 391.58±37.70 gram, 95.87±12.90 gram, and1 02.66±11.81 gram and macronutrient intake consumed by female students with normal menstruation were 2644.82±226.85 kcal, 369.31±40.40 gram, 86.69±14.32 gram, and 96.85±10.95 gram. This is illustrated most female students at the Faculty of Medicine, Andalas University were higher macronutrients intake. And also, macronutrients intake consumed by female students with irregular menstruation higher than female students with normal menstruation.

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 (Kazmierczak, *et al*., 2017). 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) (Taheri, *et al*., 2020).

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 (Wahyuni and Dewi; 2018). 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(Dieny, *et al*., 2019). 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 (Dieny, *et al*., 2019).

Table 2. Body Fat Precentage of Female Students Medical Education Study Program, Faculty of Medicine, Andalas University 2020/2021 and 2021/2022

Variable	Menstrual Cycle	
	Tidak Normal (n=33)	Normal (n=45)
	Mean ± SD	*Mean* ± SD
Body fat precentage (%)	42,71±4,42	31,66±4,44

Based on table, it can be seen that the mean of body fat percentage of female students with irregular menstruation was higher than female students with normal menstruation, with the mean of body fat percentage in female students with irregular menstruation was 42.71±4.42 % and in female students with normal menstruation was 31.66±4.44%. 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 *(Andrea, et al*., 2021).

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 (Wahyuni and Dewi; 2018).

Bivariate Analysis

Bivariate analaysis was computerized (SPSS.16 version) using independent sample t-test to determine correlation between macronutrient intake and body fat percentage with the menstrual cycle in female students Faculty of Medicine, Andalas University.

Table 3. Correlation between Macronutrient Intake with Menstrual Cycle of Female Students Medical Education Study Program, Faculty of Medicine, Andalas University 2020/2021 and 2021/2022

Variable	**p-*value***
Macronutrient intake	
• Calories (kcal)	<0,001
• Carbohydrate (g)	0,016
• Fat (g)	0,005
• Protein (g)	0,028

Based on table, we can be seen that significantly relationship between macronutrient intake (calories, carbohydrate, fat, and protein) with menstrual cycle (p-*value*: <0,001, 0,016, 0,005, dan 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 (Taheri, *et al*., 2020). (Munro, *et al*., 2022) state that lifestyle, psychological, and medical (diseases) are risk factors of menstrual irregularity.

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 (Kazmierczak, *et al*., 2017). In addition, study at Symbiosis International (Deemed) University, India was found that women with dietary fat consumption was higher than recommended diatery allowance (RDA) has irregular menstruation, such as: PMS (Thakur, *et al*., 2022). 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 (Hanapi, *et al*., 2020).

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) (Hastuti, 2019). 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. However, if energy intake is reduced for a certain period of time, it will cause a decrease of LH secretion (Barrett, *et al*., 2019; Koltun, *et al*., 2020). Besides that, protein intake is related to duration of women follicular phase. When women was haigher consumption of animal protein, she will being longer of follicular phase (Kim, *et al*., 2021).

Table 4. Correlation between Body Fat Precentage with Menstrual Cycle of Female Students Medical Education Study Program, Faculty of Medicine, Andalas University 2020/2021 and 2021/2022

Variable	p-*value*
Body fat precentage (%)	<0,001

Results of this research showed that a significantly relationship between body fat levels and the menstrual cycle with p-value = p <0.001 (p≤0.05). Andrea et al, (2021) stated that women with higher of body fat percentage has been high risk of menstrual cycle disturbances (Andrea, *et al*., 2021). 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) (Young, *et al*., 2021). In addition, study at elite female athlete from Japanese rowing team aged 16-23 years was found that correlation between of body fat precentage and menstrual irregularity (p-value =0,045) (Miyamoto, *et al*., 2021).

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 (Prathita, *et al*., 2017). Imbalance between of energy intake and energy expenditure can caused accumulation body fat in body tissues (Erdman, *et al*., 2012). Accumulation of body fat in body tissues impact to increasing secretion of estrogen (Moini, *et al*., 2020). 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 (Sholmo, *et al*., 2011).

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 (Erdman, *et al*., 2012). This condition also occurs in Padang, where as much as 55.12% of the people are categorized lack of physical activity (Ministry of Health of the Republic of Indonesia, 2018).

In this research, female students with irregular menstruation have high of body fat precentage compare to female students with normal menstruationbecause majority were obesity. Researchers assumed that female students with irregular menstruation have high of body fat precentage compare to female students with normal menstruationbecause 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.

CONCLUSION

The adventage of this research was determine about risk factors of irregular menstruation, this can be proved by results of this research that female students with irregular menstruation was comsumed more than of macronutrient intake and had higher of body fat precentage. 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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