

Effect of Nutritional Status and Fat Consumption Pattern on

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Research Article

Effect of Nutritional Status and Fat Consumption Pattern on Menstrual Cycle of Female Students in Senior High School Number 1 Padang

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Abstract

Objective: To observe the effect of nutritional status and fat consumption pattern on menstrual cycle of female students in senior high school number 1 in Padang. **Materials and Methods:** This was an analytical cross sectional study. The sample consisted of 64 female high school students that 21 participants were 16 years and 43 participants were 17 years who met the inclusion criteria and there were no exclusion criteria. The samples were taken in Senior High School (SHS) number 1 Padang from September-December, 2013. Measures used were Body Mass Index (BMI) to assess the nutritional status, the semi quantitative the food frequency questionnaire (SQ-FFQ) to assess fat consumption pattern and normal or menstrual abnormality to assess menstrual cycle. This study was analyzed by using independent t-test. **Result:** The mean of variables in normal and abnormal menstrual cycle: Nutritional status (BMI) were 20.07 ± 2.65 and 20.88 ± 3.34 kg m⁻² with $p = 0.345$, total fat consumption were 58.81 ± 30.81 and 55.38 ± 30.77 g with $p = 0.288$, cholesterol were 147.74 ± 72.46 and 173.49 ± 86.62 mg with $p = 0.181$, Saturated Fatty Acids (SFA) were 20.78 ± 8.42 and 22.87 ± 11.62 g with $p = 0.549$, Mono Unsaturated Fatty Acids (MUFA) were 3.88 ± 7.88 and 8.74 ± 5.18 g with $p = 0.487$, Poly Unsaturated Fatty Acids (PUFA) were 4.82 ± 2.29 and 5.91 ± 3.85 g with $p = 0.218$, Trans Fatty Acids (TFA) were 2.04 ± 2.09 and 2.35 ± 2.34 g with $p = 0.425$, respectively. **Conclusion:** There was no significant effect of nutritional status and fat consumption pattern on the menstrual cycle of female student in senior high school number 1 Padang.

Key words: Nutritional status, BMI, fat consumption patterns, menstrual cycle, SQ-FFQ

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

In the stage of human life cycle, developmental and physical change in the body are strongly influenced by the nutritional status. It has a significant effects on adolescent sexual development time where malnutrition is associated with the age of menarche and obesity with early sexual maturity. Nutrition and chronic diseases may cause greater body growth than normal body and lead to disorder in the onset of menarche¹.

Adolescent is about 20% of the total world population. In 1995 there were 914 million adolescents living in developing countries, 15% of the total human population in the world². Based on data from DEPKES RI in 2006, Indonesian teens (ages 10-19 years) amounted to about 43 million people or 19.61% of the population. In 2008 the number of teenagers in Indonesia is estimated to have reached 62 million³.

Nutrition and body weight play an important roles in the development of puberty. Chronic diseases, malnutrition, eating disorder, consumption patterns and heavy physical activity can interfere the process of menarche and menstrual cycle⁴. The hormonal fluctuation is associated with the menstrual cycle that affects appetite control and eating behavior of a person. Therefore, it is important to identify any dietary changes associated with the menstrual cycle so that it can be effectively treated⁵. Obesity and adipose tissue will affect the ratio of estrogen/progesterone. Androgens in blood circulation will metabolized by adipose tissue into active estrogen that affects hormonal homeostatic. Research has shown that the magnitude conversion is strongly associated with excessive body weight. Menorrhagia which relate to obesity may occur due to increase of peripheral conversion of androstenedione into estrogen. In addition, anovulatory menstrual cycles abnormality, irregular follicular maturation and menstrual phase often occurs due to temporary factors such as nutritional insufficiency or severe stress⁶.

MATERIALS AND METHODS

This was an analytical cross sectional study. The sample consisted of 64 female high school students that 21 participants were 16 years old and 43 participants were 17 years old who met the inclusion criteria and there were no exclusion criteria. The samples were taken in Senior High School (SHS) Number 1 Padang, West Sumatera, Indonesia from September-December, 2013. The inclusions criteria were students who have been menstruation in ± 5 years and willing to follow the study. The exclusions criteria were the stress

score was > 15 , hyperthyroidism based on Wayne and New Castle index, a professional athlete or regularly exercise, having obesity since childhood, suffered from heart disease, liver, kidney, hypertension, diabetes mellitus, clotting factor disorders, hereditary and psychiatric diseases. Measures used were Body Mass Index (BMI) to assess the nutritional status, the semi quantitative the food frequency questionnaire (SQ-FFQ) to assess fat consumption pattern and normal or menstrual abnormality to assess menstrual cycle. This study was analyzed by using independent t-test with computerized program.

RESULTS

Characteristics of research subjects

Menstrual cycle: Female student who had normal menstrual cycle was 43.8% (28 students) and menstrual cycle abnormality was 56.2% (36 students) (Table 1). Most of menstrual abnormality was menorrhagia 86.1% (31 students), followed by oligomenorrhea 11.1% (4 students) and menometrorrhagia 2.7% (1 student) (Table 2).

Nutritional status (BMI): Female student who categorized as thin was 25.0% (16 students), normal was 62.5% (40 students) and obese was 12.5% (8 students) (Table 3).

Table 1: Menstrual cycle distribution of female students in senior high school number 1 Padang

Menstrual cycle	Frequency	%
Normal	28	43.8
Menstrual cycle abnormality	36	56.2
Total	64	100.0

Table 2: Menstrual cycle abnormality distribution of female students in senior high school number 1 Padang

Menstrual cycle abnormality	Frequency	%
Menorrhagia	31	86.1
Hypomenorrhea	0	0
Metrorrhagia	0	0
Menometrorrhagia	1	2.7
Polymenorrhea	0	0
Oligomenorrhea	4	11.1
Intermenstrual bleeding	0	0
Secondary amenorrhea	0	0
Total	36	100.0

Table 3: Nutritional status distribution of female students in senior high school number 1 Padang

Nutritional status (BMI) (kg m ⁻²)	Frequency	%
Thin	16	25.0
Normal	40	62.5
Obese	8	12.5
Total	64	100.0

BMI: Body mass index, ¹Thin: BMI < 18.5 kg m⁻², ²Normal: BMI > 18.5 - 25.0 kg m⁻², ³Obese: BMI > 25.0 kg m⁻²

Table 4: Distribution of the average consumption of fat of female students in senior high school number 1 Padang

Parameters	Total fat (g)	Cholesterol (mg)	SFA (g)	MUFA (g)	PUFA (g)	TFA (g)
Mean	53.60	162.23	21.95	8.32	5.43	2.21
Deviation	2.61	8.11	1.03	4.56	3.28	2.22
Minimal	15.69	31.81	6.70	2.25	1.54	0.00
Maximal	178.76	405.22	69.83	31.44	23.78	11.99

SFA: Saturated fatty acids, MUFA: Mono unsaturated fatty acids, PUFA: Poly unsaturated fatty acids, TFA: Trans fatty acids

Table 5: Effect of nutritional status and fat consumption pattern on menstrual cycle of female students in senior high school number 1 in Padang

Parameters	Normal menstrual cycle		Menstrual cycle abnormality		p*
	Mean	SD	Mean	SD	
BMI	20.07	2.65	20.99	3.24	0.245
Total fat	50.91	20.81	55.70	29.77	0.600
Cholesterol	147.74	72.46	173.49	86.62	0.181
SFA	20.78	8.42	22.87	11.62	0.549
MUFA	7.80	3.68	8.74	5.16	0.497
PUFA	4.82	2.29	5.91	3.85	0.218
TFA	2.04	2.09	2.35	2.34	0.425

*Independent t-test, significant at $p < 0.05$, BMI: Body mass index, SD: Standard deviation, SFA: Saturated fatty acids, MUFA: Mono unsaturated fatty acids, PUFA: Poly unsaturated fatty acids, TFA: Trans fatty acids

Fat consumption pattern: The mean of total fat consumption was 53.60 ± 2.61 g, the mean of cholesterol consumption was 162.23 ± 8.11 mg, the mean of Saturated Fatty Acids (SFA) consumption was 21.95 ± 1.03 g, the mean of Mono Unsaturated Fatty Acid (MUFA) consumption was 8.32 ± 4.56 g, the mean of Poly Unsaturated Fatty Acid (PUFA) consumption was 5.43 ± 3.28 g, the mean consumption of Trans Fatty acids (TFA) consumption was 2.21 ± 2.22 g (Table 4).

Effect of nutritional status and fat consumption pattern on menstrual cycle of female students in senior high school number 1 Padang

Nutritional status of students in normal and abnormal menstrual cycle: The mean of nutritional status (BMI) in normal menstrual cycle was 20.07 ± 2.65 kg m^{-2} and abnormal menstrual cycle was 20.99 ± 3.24 kg m^{-2} . Statistically there was no significant difference in the mean nutritional status (BMI) of students who had normal and abnormal menstrual cycle ($p = 0.245$) (Table 5).

Total fat consumption of students in normal and abnormal menstrual cycle: The mean of total fat consumption in normal menstrual cycle was 50.91 ± 20.81 g and abnormal the menstrual cycle was 55.70 ± 29.77 g. Statistically there was no significant differences in the mean of total fat intake of students who had normal and abnormal menstrual cycles ($p = 0.600$) (Table 5).

Cholesterol consumption of students in normal and abnormal menstrual cycle: The mean of cholesterol consumption in normal menstrual cycle was 147.74 ± 72.46 mg and abnormal menstrual cycle was 173.49 ± 86.62 mg. Statistically, there was no significant differences in the mean of cholesterol of students who had normal and abnormal menstrual cycles ($p = 0.181$) (Table 5).

Saturated Fatty Acids (SFA) consumption of students in normal and abnormal menstrual cycle: The mean of Saturated Fatty Acids (SFA) consumption in normal menstrual cycle was 20.78 ± 8.42 g and abnormal menstrual cycle was 22.87 ± 11.62 g. Statistically, there was no significant differences in the mean of Saturated Fatty Acids (SFA) of students who had normal and abnormal menstrual cycle ($p = 0.549$) (Table 5).

Mono Unsaturated Fatty Acid (MUFA) consumption of students in normal and abnormal menstrual cycle: The mean of Mono Unsaturated Fatty Acids (MUFA) consumption in normal menstrual cycle was 7.80 ± 3.68 g and abnormal menstrual cycle was 8.74 ± 5.16 g. Statistically, there was no significant differences in the mean of Mono Unsaturated Fatty Acids (MUFA) of students who had normal and abnormal menstrual cycle ($p = 0.497$) (Table 5).

Poly Unsaturated Fatty Acid (PUFA) consumption of students in normal and abnormal menstrual cycle: The mean of Poly Unsaturated Fatty Acids (PUFA) Ganda consumption in normal menstrual cycle was 4.82 ± 2.29 g and abnormal menstrual cycle was 5.91 ± 3.85 g. Statistically, there was no significant differences in the mean of Poly Unsaturated Fatty acids (PUFA) of students who had normal and abnormal menstrual cycle ($p = 0.218$) (Table 5).

Trans Fatty Acids (TFA) consumption of students in normal and abnormal menstrual cycle: The mean of Trans Fatty Acids (TFA) consumption in normal menstrual cycle was 2.04 ± 2.09 g and the menstrual cycle disorder group was 2.35 ± 2.34 g. Statistically, there was no significant differences in the mean of Trans Fatty Acids (TFA) of students who had normal and abnormal menstrual cycle ($p = 0.425$) (Table 5).

DISCUSSION

Hormonal fluctuation affects the menstrual cycle and relates to homeostatic system that influenced by food intake and consumption patterns⁵. In this study, the frequency of

normal and abnormal menstrual cycle were 43.8 and 56.2%, respectively. It showed the sample were having menstrual cycle abnormality. Menorrhagia was the most common abnormality that happened in 31 female students (86.1%). The menstrual cycle coordination involves the hypothalamic-pituitary-ovarian axis and affected by physiological, pathological and psychological changes in adolescence and reproductive age⁴. Luteal phase disturbances that occur in anovulatory cycles can result an inadequate follicle and corpus luteum deficiency. Women with luteal phase disturbance may experience abnormal uterine bleeding that manifests as premenstrual bleeding, menorrhagia or polymenorrhea⁵. Abnormal uterine bleeding is most often happen in reproductive age with 20% cases in adolescence and 50% cases in women with age more than 40 years old^{6,7}.

Nutritional status is related with nutrient consumption, absorption and utilization of the human body⁸. Assessment of nutritional status directly can be done by calculating the Body Mass Index (BMI)⁹. In this study, the frequency of normal nutritional status is 62.5% with mean of BMI is $20.59 \pm 3.01 \text{ kg m}^{-2}$. It showed normal nutritional status but nearly became malnutrition.

The human body requires fat and essential fatty acid for normal growth and development. Teenagers fat needs are about 25-30% of the caloric needs¹⁰. Unsaturated fatty acid has more complex function such as endogenous bioregulator, gene transcription, signal transduction hormone, fat synthesize and affect the formation of protein¹⁰. In this study, total fat consumption patterns were lack in all samples (100%) and others fat fraction were lack too. The consumption of Trans Fatty Acid (TFA) in this study was sufficient category (62.5%). This is in accordance with the recommendations of dietary allowance of TFA consumption is not more than 1%.

Nutritional deficiency is considered as one of the important factors that induces dysfunction of the hypothalamic-pituitary-ovarian axis. Low consumption pattern in calories and fat can induce abnormality in menstrual cycle becoming shortened luteal phase. In the Japanese study of adolescents, there is a significant association between the intake of Mono Unsaturated Fatty Acids (MUFA) and serum estrogen concentrations, as well as an inverse relationship between serum androgen and estrogen¹¹. In this study there was no significant effect ($p = 0.497$). Frequency distribution of lack of MUFA was about 98.4% (63 female students).

Poly Unsaturated Fatty Acids (PUFA) acts as a solvent for vitamin A, D, E, K. Fat in the food gives a tendency raise blood cholesterol levels⁵. In this study, there is no significant effect ($p = 0.218$) in Poly Unsaturated Fatty Acid (PUFA). The

distribution of cholesterol consumption in this study shows there was no significant difference in the mean of cholesterol consumption between students with normal and abnormality menstrual cycles ($p = 0.181$). Lack of Poly Unsaturated Fatty Acid (PUFA) consumption will decrease cholesterol levels in the blood and lead to decrease estrogen levels. It will disturb the balance of estrogen, androgen and progesterone hormone that cause anovulatory menstrual cycles.

Obesity and adipose tissue can affect the ratio of estrogen/progesterone. Androgen in blood circulation is metabolized by adipose tissue into active estrogen that affects hormonal balance. This conversion is strongly associated with excessive body weight. Menorrhagia may occur due to increased peripheral conversion of androstenedione into estrogen. Besides, abnormalities in the menstrual cycle such as anovulatory menstrual cycles, irregular ripening or decay of irregular often occur as a result of several factors such as temporary nutrient insufficiency and severe stress^{6,7}.

In this study we found that the distribution of nutritional status was normal distribution with menstrual cycle disorders as much as 35.94% (23 students) and total fat consumption pattern, MUFA, PUFA are categorized as lack of fat and cholesterol and SFA consumption are categorized as more of fat. In this study we found that obesity distribution with abnormal menstrual cycle was 9.4% (6 girls) and averaged of fat consumption patterns were lower. It showed that the menstrual cycle abnormality in this group were likely caused by organic factors. In this study we couldn't rule out the possibility of abnormalities in internal genital organs. This study has important clinical implications as advice to the youth about the need of normality menstrual patterns during adolescence so that gynecologic problems can be detected earlier in the future.

CONCLUSION

There was no significant effect of nutritional status and fat consumption pattern on menstrual cycle of female students in senior high school number 1 Padang.

SIGNIFICANT STATEMENTS

Now a days, people has becoming more aware of their diet consumption as obesity become the growing problem of health condition. Women, especially, are on strict diet to maintain a stable weight without knowing the influences of food consumption on menstrual cycle. On the contrary, the hormonal fluctuations associated with the menstrual cycle can affect appetite control and eating behavior of a person

influenced by food intake and consumption patterns. The important thing in our environment today is the prevalence of food consumption patterns that are not balanced between carbohydrates, protein, fat, fiber and vitamins and minerals that can affect the menstrual cycle, especially in adolescents.

Excessive calories and dramatic weight gain can contribute to high estrogen level in a woman's blood, hence increased the risk of breast cancer, whereas a very low-calorie intake can bring menstrual cycle to a halt which in the end can also contribute to occurrence of infertility in women. Therefore, it is important to identify the nutritional status and fat consumption patterns associated with the menstrual cycle in general.

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