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ORIGINAL ARTICLE

The relationship between Ramadan fasting with menstrual cycle pattern changes in teenagers



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KEYWORDS

Menstruation;
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Pictogram

Abstract *Background:* Menstrual cycle plays an important role in female reproductive health. One of many factors contributing to affect variability of menstrual cycle is dietary pattern. During the Ramadan fasting, all dietary pattern, sleep pattern, and daily activities will be altered and thus contributing to menstrual cycle.

Objective: To assess the relation between Ramadan fasting and menstrual cycle changes among teenagers.

Methods: This is an observational study with cohort prospective approach. 85 female students of 1 Senior High School in Manyak Payed District were enrolled in this study. Respondents were asked to fill the questionnaires regarding menstrual cycle for 4 consecutive months to assess their menstrual cycle. Parameter observed was changes in menstrual cycle which could be in duration, frequency, and menstrual blood volume. For menstrual blood volume, the quantification was using menstrual pictogram questionnaire.

Results: Among 85 female students enrolled, 14 students were menorrhagia and 6 students were oligomenorrhea during Ramadan fasting. There was no difference in menstrual cycle abnormalities during Ramadan fasting between the respondents who started fasting in follicular phase or luteal phase ($p > 0.05$). However, for menstrual blood quantification, there was a significant difference between menstrual blood volume before and during Ramadan fasting marked by the increased mean in menstrual blood volume as much as 13.84 mL with p value < 0.001 .

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Conclusion: During Ramadan fasting, there were changes in teenagers' menstrual cycle especially in menstrual blood volume. There was significant difference ($p < 0.001$) in menstrual blood volume before and during Ramadan fasting.

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1. Introduction

Menstrual cycle plays an important role in female reproductive health. Menstruation is a normal physiologic process regulated by hormonal action and interaction between hypothalamus, pituitary, and ovaries [1]. Generally, menstrual cycle has 4 dimensions which consist of regularity, menstrual frequency, menstrual duration, and menstrual blood volume [2].

There are many factors contributing to variability of menstrual cycle. Those factors alter or suppress hormonal secretion rhythm in hypothalamus-pituitary-ovaries axis. Variability during follicular phase may be caused by ovulation disturbance. Variability during luteal phase may be caused by ovulation process, defect in corpus luteum, and inadequate estrogen and progesterone production [3].

Median length of normal menstrual cycle is 28–30 days. Menstrual duration usually takes 5 days, with the menstrual blood volume 25–35 mL [4]. Women in reproductive age usually complain about having menstrual cycle disturbance once in a life-time. Those complaints may be about cycle irregularity, and about 37% complaint about shorter or longer menstrual cycle [5,6]. Many factors might cause menstrual cycle irregularity, for example smoking, exercise, diet, body mass index, age of menarche, and psychosocial stressor [7]. Thus, it is important to know about normal variability in menstrual cycle because it might be the first sign and symptom of reproductive abnormalities in women [3,8].

One of many factors contributing to affect variability of menstrual cycle is dietary pattern [8]. During Ramadan, millions of Moslem worldwide are going through Ramadan fasting. Fasting in Islam religion, is avoiding any kind of meal and drink starting from the dawn until sunset. In Indonesia, Ramadan fasting time lasts for 14 h a day for one full month. The difference may be major (In Indonesia e.g. may reach up to 60–72 min). During Ramadan fasting, all dietary pattern, sleep pattern, and daily activities will be altered and thus contributing to menstrual cycle [9].

Nowadays, many researches and studies in medical science focus on clinical effect of fasting for health purpose and risk for systemic diseases. Menstrual cycle is an important indicator for women reproductive health. However, only few studies have shown the effect of Ramadan fasting to menstrual cycle.

2. Material and methods

This is an observational study with cohort prospective approach to assess the relation between Ramadan fasting and menstrual cycle in female teenagers. We collected the data in 4 consecutive months starting from March 2015 until July 2015. This study was conducted in 1 Senior High School of Manyak Payed District, Aceh Tamiang, Aceh Province, Indonesia.

The inclusion criteria were female teenagers between 15 and 19 years old; normal body mass index ($18.5\text{--}23\text{ kg/m}^2$); age of menarche between 12 and 15 years old; and obtained informed consent.

The exclusion criteria were having amenorrhea or not having menstruation in 3 consecutive months; having one or more abnormalities in menstrual cycle (hypermenorrhea/menorrhagia, hypomenorrhea, oligomenorrhea, polymenorrhea, and/or metrorrhagia); irregular menstrual cycle in last 3 months; planning on not going thorough Ramadan fasting; having regular fasting beside the Ramadan fasting; having routine heavy exercise (aerobic or anaerobic exercise more than 5 times per week with more than one hours per day in duration and heavy intensity); having significant weight changes in last 3 months; having physical and psychosocial stressors that altered menstrual cycle in last 3 months; having long term steroid therapy, chemotherapy, hormonal therapy, or radiotherapy; and having chronic illnesses (hyperthyroid, heart failure, chronic anemia, and malignancy).

The data collected in this study were primary data. Every respondent had been informed of the purposes of this study, the procedures, and data collected. Informed consents have been obtained from the respondents' parents or guidance. Every respondent had agreed to share the data collected regarding the publication of this study. This study had been approved by ethical committee of University of Sumatera Utara, Medan, North Sumatera, Indonesia.

Data collection was via questionnaire that was filled by respondent. In the beginning of the study, baseline data about history of menstrual cycles, history of physical activity, medical conditions and drugs consumed, were obtained from every respondent. For the body mass index data, every respondent had their weight and height measured directly.

Data were collected every month starting three months before Ramadan fasting and one month during Ramadan fasting to assess regularity of menstrual cycle and its changes. The measured data were nominal and numerical data for menstrual blood volume.

The respondent who started Ramadan fasting in follicular phase (between day-1 and 14 days before first day of her next menstrual cycle) was considered in follicular group. Luteal group were respondents who started Ramadan fasting 14 days or more before first day of her next menstrual cycle (luteal phase).

Menstrual cycle changes were deviation in regularity, frequency, duration, and menstrual blood volume. The respondents were menorrhagic if menstrual blood volume exceeded 80 mL per cycle or having more than 8 days of menstruation; hypomenorrhagic if menstrual blood volume was less than 30 mL per cycle or having less than 3 days of menstruation; polymenorrhagic if menstrual cycle was less than 21 days; and oligomenorrhagic if menstrual cycle was more than 35 days. Metrorrhagia was considered when uterine bleeding occurs outside the menstrual cycle.

For quantification of menstrual blood volume, we used menstrual pictogram (pictorial charts) that has been standardized.

All data analyses were processed with SPSS software for Windows version 22. Data analysis used was Chi-square or Fisher-exact test to compare the menstrual cycle changes. T-paired test would be used to assess menstrual blood volume changes if normally distributed (using Kolmogorov-Smirnov test) or Wilcoxon test if abnormally distributed.

3. Results

In the beginning of the study, 108 female students were enrolled in the study. 17 respondents were excluded and the remaining 6 respondents were dropped out from the study. 85 respondents completed the study. Every participant was 15–18 years old, fulfilling inclusions criteria, and failing exclusions criteria. Characteristics observed were respondents' age, age of menarche, body mass index, length of menstrual cycle, and menstrual duration. Respondents' characteristics can be viewed in Table 1.

In this study, we split the respondents into two groups, one group consist of respondents who were starting Ramadan fasting on follicular phase and the other group who were starting Ramadan fasting on luteal phase of menstrual cycle. The homogeneity between two groups is shown in Table 2.

Based on Table 2, the $p > 0.05$ declared that there is no characteristic difference between respondents in follicular

phase group and luteal phase group. Thus, those two groups were homogeneous.

3.1. The comparison of menstrual cycle during Ramadan fasting

This study compares menstrual cycle (menstrual blood volume, duration, and length of cycle) between two subject groups who started Ramadan fasting on follicular or luteal phase. The comparison of menstrual cycle between two groups is shown in Table 3.

Based on Table 3, 8 respondents on follicular phase group and 6 respondents on luteal phase group had menorrhagia. There was no statistically significant difference in duration of menstruation ($p = 0.466$).

Based on length of cycle, oligomenorrhea cases were found on follicular phase group (1 case) and luteal phase group (5 cases). There was no statistically-significant difference in length of menstrual cycle ($p = 0.204$).

3.2. The comparison of menstrual blood volume before and during Ramadan fasting

In this study, we also compare menstrual blood volume before and during Ramadan fasting. Data were normally distributed ($p > 0.05$). Mean of menstrual blood volume is shown in Table 4.

As shown in Table 4, there was a statistically-significant increase in the mean menstrual blood volume before and during Ramadan fasting ($p < 0.001$). This statistically significant difference was also found among the follicular and luteal phase groups.

Table 1 Distribution of respondents' characteristics.

Characteristics	Frequency (n)	Percentage (%)
<i>Age (years)</i>		
15	40	47.1
16	36	42.4
17	7	8.2
18	2	2.4
<i>Body Mass Index</i>		
< 18.5 kg/m ²	0	0
18.5–23 kg/m ²	85	100
23–25 kg/m ²	0	0
> 25 kg/m ²	0	0
<i>Menstrual Cycle</i>		
< 21 days	0	0
21–27 days	43	50.6
28–35 days	42	49.4
> 35 days	0	0
<i>Menstrual Duration</i>		
< 3 days	0	0
3–8 days	85	100
> 8 days	0	0
<i>Age of Menarche (years)</i>		
12	41	48.2
13	30	35.3
14	11	12.9
15	3	3.5
Total	85	100

Table 2 The comparison of homogeneity between two groups.

Characteristics	Mean (SD)		p-value
	Follicular	Luteal	
Age	15.73 (0.70)	15.59 (0.76)	0.379
Body Mass Index	20.13 (1.23)	20.15 (1.52)	0.954
Menstrual Duration	6.32 (1.15)	6.41 (1.06)	0.702
Age of Menarche	12.73 (0.84)	12.70 (0.82)	0.881

Table 3 The comparison of menstrual cycle during Ramadan fasting.

Start Ramadan Fasting	Duration and Volume of Menstrual Blood		Length of Cycle	
	Normal	Menorrhagia	Normal	Oligomenorrhea
Follicular Phase	33	8	40	1
Luteal Phase	38	6	39	5
p-value	0.466		0.204	

4. Discussion

This study assessed the impact of Ramadan fasting to menstrual cycle changes among female teenagers. Respondents were chosen with the assumption of having similar confounding factors such as stressors, environment, and dietary pattern.

There are many factors contributing to variability of menstrual cycle. Those factors alter or suppress the rhythm of hormonal secretion in hypothalamus-pituitary-ovaries axis. One of those contributing factors is body fat, marked by increase in body mass index (BMI), and has significant correlation with prolonged and irregular menstrual cycle. Women with BMI 24–25 kg/m² have twice increased risk of having prolonged menstrual cycle compared to those with BMI 22–23 kg/m² [7]. In this study, we chose normal BMI to eliminate body fat as confounding factor.

Having menarche before 12 years old is associated with shorter menstrual cycle. However, having menarche after 15 years old increases the risk of prolonged menstrual cycle up to 3 times [7]. In this study, the respondents were having menarche on age of 12–15 years.

Smoking is associated with shorter and irregular menstrual cycle. This risk is up to 3.6 times higher compared to women who do not smoke. Smoking may cause shorter follicular phase on menstrual cycle [7]. All respondents in this study were not smoking and did not have medical conditions (such as Grave's disease, diabetes mellitus, and depression) that might affect the menstrual cycle.

Respondents had similar stressor because they were similar in age and had similar activities in school (not in exam period). This was important because in the event of stress, HPO axis is activated and hypothalamus will start to excrete corticotrophin releasing hormone (CRH). CRH has negative impact on regulation of gonadotrophin releasing hormone (GnRH) secretion. CRH imbalance suppresses reproductive function during stress. CRH secretion will stimulate adrenocorticotrophic hormone (ACTH) secretion from anterior pituitary and it also stimulates adrenal gland to secrete cortisol. Cortisol will suppress LH pulsatile release through reducing the effect of GnRH to anterior pituitary. Cortisol hormone will alter hormonal balance; hence, the menstrual cycle would become irregular. As an addition, heavy physical activity such as having exercises more than 4 h per day might cause prolongation of menstrual cycle. This is caused by reduction of follicle stimulating hormone (FSH) secretion during follicular-luteal transition phase, hence causing prolongation of follicular phase and delay of corpus luteum appearance [7]. All respondents in this study did not have heavy physical activity.

For menstrual blood volume quantification, we used menstrual pictorial chart (pictogram) that was standardized. This is the best method to quantify menstrual blood and the most

applicable method [10]. Wyatt et al. showed that there was significant positive correlation between the ability of women to assess blood loss during menstruation and the actual blood loss using alkaline-hematin technique [11]. Hence, menstrual pictorial chart (pictogram) is the most accurate and applicable method to assess and quantify menstrual blood loss for clinical or research purposes.

In the study conducted by Yavangi et al., there were some menstrual cycle changes on respondents who undergo Ramadan fasting (30% of respondents from 80 respondents had menstrual cycle changes, $p < 0.0001$), with the abnormalities varying from oligomenorrhea, polymenorrhea, to menorrhagia [12]. Those findings were similar with our study that there were 14 cases of menorrhagia and 6 cases of oligomenorrhea from the previously normal respondents. But, on the Yavangi's study, in the beginning of the study, not all of the respondents had normal menstrual cycle and some of them had abnormal body mass index (too fat or too skinny). Those factors might confound the results as we discussed before.

In our study, in the follicular phase group, the respondents were fasting longer than luteal phase group before having menstruation. However, there was no statistically significant difference in menstrual cycle between respondents in both groups. There was a statistically significant increase in mean menstrual blood volume before and during Ramadan fasting ($p < 0.001$).

During Ramadan, Muslims who undergo Ramadan fasting will have altered meal pattern. They will eat and fast on the same time for a full month. There also might be some changes in daily activities such as sleep pattern (awake early to have some meal) and going back to sleep. Those changes may contribute in alteration of hormones secretion. During Ramadan fasting, changes in body weight and food consumption may alter the body fat amount. Some people might lose some weights while other gains some weights. It is affected by calories, proteins, and fat consumed during Ramadan [13,14].

Diminished food consumption during Ramadan may alter metabolic and neuroendocrinal responses thus contributing to amenorrhea [15,16]. Researches showed that binge eating once a day may impact in metabolic changes such as increase in fasting glucose level, increased insulin response and modulation of leptin diurnal rhythm [17,18]. Serum leptin concentration showed diurnal variety pattern with peak concentration at midnight. Fasting may cause gradual decrease in leptin concentration, first seen after 6–8 h of fasting. Leptin may affect hypothalamus-pituitary-ovaries axis through its effect on hypothalamus and increasing LH-RH (luteinizing hormone-releasing hormone) release. Thus, pituitary will be stimulated to increase release of LH and FSH and ovaries will stimulate steroidogenesis [19,20]. Those factors contribute to menstrual cycle changes during Ramadan fasting.

Table 4 Mean of menstrual blood volume before and during Ramadan fasting.

	Before Ramadan Fasting (SD)	During Ramadan Fasting (SD)	Mean Difference	<i>p</i> -value
Menstrual blood volume of all respondents (mL)	49.14 (12.11)	62.98 (17.70)	13.84	< 0.001
Menstrual blood volume (mL) (follicular phase group)	48.02 (12.96)	61.32 (17.73)	13.29	< 0.001
Menstrual blood volume (mL) (luteal phase group)	50.18 (11.32)	64.52 (17.75)	14.34	< 0.001

Fasting in short period of time (3 days during midfollicular phase on menstrual cycle) might diminish pulsatile release of LH. On midluteal phase, there would be an increase in serum cortisol, decreased serum leptin, insulin, and IGF-1 [21]. If someone refuses to eat for long period of time, such as anorexia nervosa, secretion of reproductive hormones might be suppressed due to low leptin concentration; hence, reproductive function would be abnormal [22].

There are only few researches focusing on direct impact of Ramadan fasting on menstrual cycle changes. We considered that respondents on this study were limited. Further investigation may be needed to assess menstrual cycle changes during Ramadan fasting with more subjects and measuring hormones concentration that might contribute to menstrual cycle changes.

5. Conclusion

This study showed that there were changes in teenagers' menstrual cycle during Ramadan fasting especially in menstrual blood volume. There was statistically significant difference ($p < 0.001$) in menstrual blood volume before and during Ramadan fasting. However, there was no statistically significant difference in menstrual cycle abnormalities (menorrhagia and oligomenorrhea) between respondents who started Ramadan fasting either in follicular or in luteal phase.

Conflict of interest

The authors have no conflict of interest.

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