

## Research Article

# Adiposity Measures and Menstrual Cycle: Do We Envisage a Relation?

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The study aims to see the relationship between menstrual cycle and adiposity measures in Indian populations as menstrual cycle length has an important bearing on fertility and health of women. 415 premenopausal women in the ages 22–50 years residing in Delhi, India constituted the data. The adiposity was assessed by BMI as well as by using Bio-electric impedance method. The information regarding their physical activity pattern and menstrual cycle was recorded, and age at menarche was obtained through recall method. None of the underweight category women had menstrual cycle of less than 25 days. A decrease in body mass index and an increase in the age at menarche were found with the increase in the duration of menstrual cycle. The majority of women with 25–35 days duration of menstrual cycle in the present study were distributed in all the categories of BMI. Age was found to have no effect on longer cycle. The majority of women were in moderately physically active group and experienced menstrual cycle duration of 25–35 days. It is of utmost importance to identify the effects of moderate levels of physical activity, body mass index, and age at menarche on the menstrual cycle to enable the normal reproductive health of women.

## 1. Introduction

Menstrual cycle length is a noninvasive clinical marker of reproductive function [1]. It has also been used to assess the reproductive effects of environmental and occupational exposures such as organic solvents [2–8]. Menstrual cycle length has also been investigated as a predictor of health outcomes including breast cancer [9, 10] and cardiovascular disease risk factors [11]. Variation in menstrual cycle length in population studies has been studied by Munster et al. [12], Chiazze et al. [13], Treloar et al. [14]. Most commonly the length of menstrual cycle is 28 days. Invariably, the menstrual cycle length is least variable in women between 20 and 45 years of age [12–14]. It has been reported that premenopausal women over 45 years of age would include an increasing proportion of women who are perimenopausal based on self-reported increased cycle length irregularity [15]. Information on the length and variability of the menstrual cycle is noticed in studies conducted in populations of predominantly European descent [13, 14, 16] and Japanese women [17]. World Health Organization [18] has published

a series of short-term studies of menstrual bleeding patterns from industrialized and developing countries including studies of adolescents. A scattering of other smaller studies has provided data on menstrual function in adolescent Swiss [19], Nigerian girls [20], and Indian women [21]. Fluctuations in regulatory hormones, body temperature and other physiological mechanisms during the menstrual cycle cause individual symptoms including a perceived weight gain.

The effect of adiposity measure on menstrual cycle length has been studied less extensively. Not many studies have been conducted on relationship between menstrual cycle and adiposity measures in Indian populations. The present study aims for the same.

## 2. Material and Method

Data was collected on 415 premenopausal women using multiple stage stratified sampling technique in the age groups 22–50 years residing in national capital territory of Delhi, India. The study participants were all married belonging

to high socioeconomic group and did not suffer from any gynecological complications. These women had not attained menopause experiencing normal menstrual cycle and were designated as premenopausal women throughout the text for the sake of convenience. Before commencing the data collection, consent was sought from the women to participate in the study after explaining the objective of the research. A detailed schedule was structured to collect necessary information from the subjects. Stature and weight were recorded as per the guidelines suggested by Weiner and Lowrie [22]. Adiposity measure was assessed by BMI and by using Bio-electric impedance method. WHO [23] standards for BMI were used for the study. The information regarding their menstrual cycle was also recorded and in this study cutoff points for menstrual cycle length were those used by Bachand et al. [24]. Age at menarche was obtained through recall method. Physical activity of the study participant was adjudged recorded by recoding the frequency and duration of their activity.

### 3. Results

Majority of the study participants comprised of women in the age group 30–34 years (26.0%) as shown in Table 1 and only 7.8% represented women in the age group 45–50 years.

The mean age of the study participants was 34.55 years and mean age at menarche was 13.44 years (Table 2). The mean weight and stature were 63.69 kg and 155.25 cm, respectively with the mean BMI as 26.48 kg/m<sup>2</sup>.

Table 3 shows the distribution of premenopausal women according to length of their menstrual cycle. Maximum women (25.36%) with the length of their menstrual cycle between 25–35 days were up to 29 years followed by 24.78% in the age group 30–34 years. It is observed that in all the age groups of this study, maximum women experienced menstrual cycle of duration 25–35 days.

The maximum number of women (43.29%) with 25–35 days of menstrual cycle was in overweight category. The minimum number of women (0.31%) with menstrual cycle length of more than 35 days was in underweight category as shown in Table 4. The majority of the women had 25–35 days of menstrual cycle in all the categories of BMI. It was observed that women in both less than 25 days and more than 35 days of menstrual cycle length were relatively less in number. 2.44% of overweight/obese women were found to have less than 25 days menstrual cycle while only 1.83% were in normal category. Most of the women who experience regular menstrual cycle duration are found to be moderately physically active. No women are found to be experiencing menstrual cycle of less than 25 days in physically inactive/sedentary group and only 0.58% in the same group has more than 35 days menstrual cycle duration.

Table 5 shows the mean value of BMI according to the duration of menstrual cycle. The BMI appears to be decreasing with the duration of the menstrual cycle. It was found that the three groups of women differed with respect to their BMI and the differences were statistically significant ( $F$ -value  $P = .05$ ). Age at menarche was also found to increase with an increase in the length of menstrual cycle.

TABLE 1: Distribution of participants in different age groups.

Age group	Percent
Up to 29 years	25.3
30–34 years	26.0
35–39 years	25.5
40–44 years	15.4
45–50 years	07.8

TABLE 2: Basic information of the participants.

Variable	Mean	±SD
Age (yr)	34.55	06.50
Age at menarche (yr)	13.44	01.47
Weight (kg)	63.69	11.48
Stature (cm)	155.25	05.83
BMI kg/m <sup>2</sup>	26.48	04.37

TABLE 3: Menstrual cycle length by age groups.

Age group	Menstrual cycle		
	<25 days (%)	25–35 days (%)	>35 days (%)
Up to 29 years	0.58	25.36	1.75
30–34 years	0.58	24.78	0.88
35–39 years	1.46	22.74	—
40–44 years	0.58	12.25	0.58
45–50 years	0.88	7.58	—

### 4. Discussion

Menstrual cycle has an important bearing on fertility and health of women. Irregular menstrual cycles have especially been used as an indicator of reproductive health. The length and regularity of the menstrual cycle is an indicator of cumulative exposure to ovarian steroids. Irregular menstruation with large variability in the cycle length often indicates anovulatory cycles, which may be associated with reduced production of ovarian steroid, while shorter regular cycles have been associated with increased cumulative exposure to ovarian steroid [25].

In the present study, none of the underweight category women had menstrual cycle of less than 25 days. These women were reported to be having poor appetite. Prolonged amenorrhea very frequently accompanied by anorexia nervosa was observed by Biller et al. [26] and Klibanski et al. [27].

Among the premenopausal women in the present study, there was a decrease in body mass index with the increase in the duration of the menstrual cycle. The difference in the mean value of BMI according to the duration of menstrual cycle between the three groups of subjects was found to be statistically significant. Harlow and Matanoski [28] demonstrated that overweight is associated with the probability of long cycles in college women, but Liu et al. [29] found no association of BMI with any outcomes in their older and more ethnically diverse population. Symons et al. [30] found the relationship between each body composition

TABLE 4: Menstrual cycle length by BMI and physical activity.

Menstrual cycle length	Body mass index				Physical activity	
	Underweight (%)	Normal (%)	Overweight (%)	Obese (%)	Physical activity (%) (Moderate)	No Physical activity (%) (Sedentary)
<25 days	—	1.83	1.22	1.22	4.08	—
25–35 days	0.91	30.49	43.29	17.68	85.43	7.29
>35 days	0.31	1.83	0.61	0.61	2.62	0.58

TABLE 5: BMI in relation to length of menstrual cycle.

Menstrual cycle length	Age at menarche (yr)	Body mass index (kg/m <sup>2</sup> )		F-value ( <i>P</i> = .05)
		Mean	± SD	
<25 days	13.04	27.25	1.22	2.950 ( <i>P</i> = .05)
25–35 days	13.45	26.61	17.68	
>35 days	13.77	23.63	0.61	

measure and cycle length to be nonlinear with the longest mean cycle lengths occurring with greater BMI and lowest BMI. In the present case too, the longest menstrual cycle was found among both the ends of BMI. The women in the present study were distributed in all the categories of BMI, but dominated in 25–35 days duration of menstrual cycle which has been considered to be the regular menstrual cycle length according to Bachand et al. [24].

The impact of excess body weight or body fat mass on menstrual cycle has drawn less attention than low body weight. In the present study, 2.44% overweight/obese women had menstrual cycle duration of less than 25 days whereas only 1.83% normal weight women experienced similar length. During childhood and puberty, well-nourished human females deposit 15–20 kg of fat, representing 25–30% of body weight, mainly in subcutaneous tissues of the hips and thighs [31–34]. Harlow and Matanoski [28] found that women at the upper end of body mass distribution were more likely to have long cycles (>43 days) whereas Kirchengast [35] reported that increased amount of subcutaneous body fat was negatively correlated with cycle lengths, purportedly due to extraglandular production of oestrone and oestradiol in adipose tissue.

In the present study with the increase in the duration of menstrual cycle, the BMI decreased and the age at menarche increased. Also, longer cycles are not common with advancing age. Kato et al. [25] also found that the length of regular menstrual cycle increased with increasing age at menarche, BMI, and parity. Rowland et al. [36] report longer menstrual cycle with menarche after 14 years which is same as in our study, with the only difference being in their subjects women with longer cycles also had more BMI unlike present study when the BMI is lower. Our findings agree with that of Rowland et al. [36] so far late menarche and age is concerned but difference in the direction of BMI versus menarche cycle length is evident. This difference could be due to different physical activity levels practiced habitually in two groups of subjects; the urban Indians were mostly

homemakers whereas the Canadian subjects belonged to farming families.

A few epidemiologic studies suggest that women participating in moderate recreational activity have longer and more variable cycles than do sedentary women [28], [37], and amenorrhea has been induced in previously sedentary women with the initiation of a vigorous training program [38]. In the present study, majority of the women who were physically active experienced regular menstrual cycle duration whereas no women in physically inactive group was found to be experiencing less than 25 days of menstrual cycle and only 0.58% had more than 35 days menstrual cycle duration. On the other hand, menstrual cycle disturbances have been noted in highly trained female athletes, for example, marathon runners and gymnasts [39–41]. Sternfeld et al. [42] findings lend modest support to the hypothesis that moderate levels of physical activity can lengthen the menstrual cycle.

The factors which could be responsible for the variation in menstrual cycle are poorly understood. The outcome of the present study show that women who are moderately physically active experience regular menstrual cycle. Increased age of menarche and decrease in body mass index shows increase in the duration of menstrual cycle, thereby contributing to the deviated menstrual cycle length. From a public health perspective, understanding the effects on the menstrual cycle of moderate levels of physical activity, body mass index, and age at menarche is most relevant. It is of utmost importance to identify the cause for deviation in menstrual cycles to enable the normal reproductive health of women.

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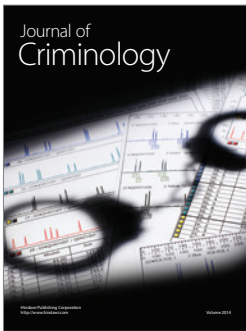
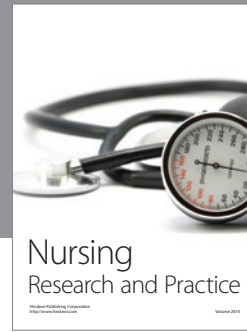
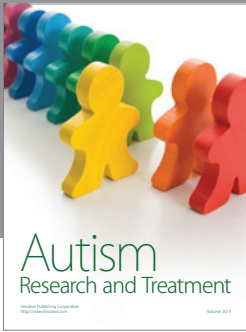
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