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PJBS

ISSN 1028-8880

**Pakistan
Journal of Biological Sciences**

ANSI*net*

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Body Weight Changes During the Menstrual Cycle among University Students in Ahvaz, Iran

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Abstract: Weight changes during menstrual cycle may be a cause of concern about body weight among most women. Limited data are available linking menstrual cycle and body weight changes. The aim of this study was to examine the relationship between menstrual cycles and body weight changes among university students in Ahvaz, Iran. This cross-sectional study was conducted on 50 Iranian female students aged 18-24 years. Anthropometric indices were measured according to standard protocols. During a complete menstrual cycle, weights of participants were measured each morning. Seventy eight percent of participants had normal weight (Body Mass Index: 18.5-24.9 kg m⁻²). Body weight increased only slightly during the three days before beginning of the menstruation. By using repeated-measures ANOVA, no statistically significant differences were found in weight during menstrual cycle (p-value = 0.301). No statistically significant changes were found in body weight during women's menstrual cycle in a group of healthy non-obese Iranian young women. Further studies on overweight and obese women are suggested.

Key words: Weight changes, menstrual cycle, body mass index

INTRODUCTION

Obesity is one of the major public health problems in the developed and developing countries and is an independent risk factor for chronic diseases including hypertension, Cardiovascular Diseases (CVD), type 2 diabetes mellitus and certain cancers (Anonymous, 1998). In the United States obesity has increased more than 20% in the past decade. More than 35% of American adults are obese (Flegal *et al.*, 2002; Ogden *et al.*, 2012). In Iran, the prevalence of overweight and obesity is 42.8 and 11.1% in men and 57 and 25.2% in women, respectively (Janghorbani *et al.*, 2007). Many people in the world attempt to lose weight, or to prevent weight gain or sustain initial weight loss. Dietary modification, physical activity and healthy eating behavior are effective strategies for the prevention and management of obesity. According to the data of the National Health Interview Survey which included 32 440 Americans, 24% of the male and 38% of the female populations were trying to lose weight, respectively (Kruger *et al.*, 2004). Generally, in women population, the number trying to lose weight is

more than men. Approximately one-fourth of women in the United States of America with normal weight (BMI < 25) as well as 58% of obese females (BMI < 30) were trying to lose weight. It seems that women are more dissatisfied with their body appearance than men (Poppitt *et al.*, 1994; Kruger *et al.*, 2004; Davidsen *et al.*, 2007). Bendixen *et al.* (2002) in an observational study have shown a direct significant relationship between BMI and weight loss attempt. Weight-loss attempt in women (61%) was more frequent than men (32%). Losing weight may be more difficult in women than men. In addition during weight management programs women lose less weight. It may partly be due to metabolic differences between genders (Sartorio *et al.*, 2005; Anderson *et al.*, 2007). The female sex hormones significantly affect women's weight and body composition. The reproductive hormones control the menstrual cycle in women and it can affect energy intake, energy expenditure and fat storage (Poppitt *et al.*, 1994). The influences of hormonal changes throughout the menstrual cycle on weight loss in women are not clear. An increase in food intake has been shown to be influenced by the hormonal changes within the

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menstrual cycle and may account for an increase in body weight and body fat (Davidsen *et al.*, 2007). Energy intake and energy expenditure are increased during luteal phase of the menstrual cycle. In this phase women have more eager to consume high carbohydrate and high fat foods compared to the follicular phase (Tarasuk and Beaton, 1991; Danker-Hopfe *et al.*, 1995; Li *et al.*, 1999). Based on the available evidence women in the luteal phase of the menstrual cycle have higher intakes of energy as much as 90-500 kcal day⁻¹, compared with the follicular phase (Dalvit, 1981; Tarasuk and Beaton, 1991; Martini *et al.*, 1994; Barr *et al.*, 1995; Li *et al.*, 1999; Cross *et al.*, 2001; Pelkman *et al.*, 2001). These changes may cause an increase in energy intake and may lead to weight gain and increase the risk of overweight or obesity in women during the reproductive age.

The influence of menstrual cycle on body composition has been investigated in few studies (Eck *et al.*, 1997; Kirchengast and Gartner, 2002). Golub *et al.* (1965) reported weight changes of sixty-nine females; 43.5% of them experienced their highest weight during the first days of menstruation and 20% experienced their highest weight prior to menstruation (Watson and Robinson, 1965) reported an increase in body weight during the first half of menstruation. Many females are concerned about their body weight. Weight changes during a woman's menstrual cycle may be a cause of concern especially for those who are trying to reduce their weight (Malinauskas *et al.*, 2006; Anderson *et al.*, 2007). To our knowledge, there is no study regarding the relationship between menstrual cycles and body weight changes in Iran. Therefore, in the present study, the changes in body-weight during the menstrual cycle among female university students in Ahvaz, Iran were studied.

MATERIALS AND METHODS

Participants of present study were 50 female students who were living in Golestan dormitory of Ahvaz Jundishapour University of medical sciences. Ahvaz is located in the southwest of Iran. Participants were selected by cluster random sampling method. They were in the age range of 19-24 years. Written informed consents were obtained from all participants.

Weight of participants during a complete menstrual cycle was measured each morning (between 8 -10 a.m.) by using a digital scale (Seca Corp, Hamburg, Germany) with an accuracy of 100 g and was done with minimal clothing and without shoes. Height was measured by using

inflexible tape while subjects were standing erect in the normal position of shoulders and without shoes and recorded to the nearest 0.1 cm. To reduce measurement error, all measurements were performed by one trained dietitian. Body mass index (BMI) was calculated by dividing weight (in kilograms) by height squared (in meters squared).

Statistical analyses were performed with the Statistical Package for Social Sciences version 20 (SPSS Inc, Chicago, IL). Descriptive statistics were used for reporting the mean and standard deviation. Mean and standard deviation of average weights of 1-3, 4-6, 7-9, 10-19 and the last three days of one menstrual cycle are reported here. Repeated-measures ANOVA was used to test for statistically significant changes in weight during menstrual cycle.

RESULTS

Frequency distribution of age groups and BMI categories (underweight, normal weight, overweight) are shown in Table 1. It seems that more than half of participants were aged 20 to 22 years old. The sample as a whole was young (21.4±1.19 year). More than 70% of participants had normal weight (BMI 18.5-24.9 kg m⁻²). The average BMI was 21.4±2.7 kg m⁻². Means and standard deviations of weights during menstrual cycle are shown in Table 2. Body weight increased only slightly during the three days before beginning of the menstruation. By using repeated-measures ANOVA, no statistically significant differences were found in weight during menstrual cycle (p-value = 0.301).

Table 1: Frequency distribution of age (year) and BMI (kg m⁻²) of female university students in Ahvaz, Iran (N = 50)

| Parameters | Frequency | Percent |
|-----------------------|-----------|--------------|
| Age | | |
| 18-20 | 14 | 28.0 |
| 20-22 | 27 | 54.0 |
| 22-24 | 9 | 18.0 |
| BMI | | |
| <18.5 | 6 | 12.0 |
| 18.5-24.99 | 39 | 78.0 |
| 25-29.99 ¹ | 5 | 10.0 |
| Total | 50 | 100.0 |

¹Overweight: 24.99≤BMI≤29.99 kg m⁻²

Table 2: Changes in weight (kg) during menstrual cycle in female university students in Ahvaz, Iran (N= 50)

| Days of menstrual cycle | Mean±SD |
|-------------------------|------------|
| 1-3 | 53.76±8.42 |
| 4-6 | 53.68±8.43 |
| 7-9 | 53.62±8.48 |
| 10-19 | 53.71±8.36 |
| Last 3 days | 54.38±9.32 |

DISCUSSION AND CONCLUSION

In the present study, we found that weight had no significant change during menstrual cycle days among a group of Iranian adult young students. Few studies have been conducted on the influence of menstrual cycle on body composition. In Byrd and Thomas (1983) study twelve females were assessed three different times during each menstrual cycle for a total of six measurements within two periods. They reported fluctuations in body composition among the women but since the participants did not weigh every day, peak weight gains may not have been detected (Byrd and Thomas, 1983). The menstrual cycle has been reported to influence water retention and thus weight gain in most women however, the results of studies are not consistent. Golub *et al.* (1965) reported among sixty-nine females who kept daily records of their body weight for four months, 20% women experienced their highest weight prior to menstruation while 43.5% of them experienced their highest weight during the first days of menstruation. On the contrary, the results of study, on thirty patients in a clinical setting, illustrated that the group as a whole did not experience weight gain prior to menstruation. Each participant was weighed daily for three months. Control groups (33% of the patients) were restricted to hospital living conditions and meals. Case group (67% of participants) experienced a slight change in body weight during the menstrual cycle which may have been attributed to the unrestricted living conditions outside the hospital. The control group was reported to experience a slight increase in weight (<500 g) five days prior to the onset of menses. Similarly, a fluctuation in daily weight of 0.59 to 2.07 kg in women throughout the menstrual cycle with an increase in weight prior to menstruation was reported by Watson and Robinson *et al.* (1965) In similar study with the same subjects, (Watson and Robinson, 1965) mentioned an elevated in body weight during the first half of menstruation with a decrease in body weight near the end of menstruation.

Obviously reproductive hormones control the menstrual cycle in women and may cause changes in their energy metabolism and appetite (Poppitt *et al.*, 1994). These changes coordinate to changes in energy intake, expenditure and storage and may contribute to weight gain during woman's menstrual cycle (Poppitt *et al.*, 1994). According to the available reports, reproductive hormones may be strong mediators of eating behavior in women that may influence the outcome of a weight loss attempt (Davidsen *et al.*, 2007). Women in the luteal phase of the menstrual cycle had higher intakes of energy compared with the follicular phase although these increases have not always been statistically significant

(Dalvit, 1981; Tarasuk and Beaton, 1991; Martini *et al.*, 1994; Barr *et al.*, 1995; Li *et al.*, 1999). In addition, women have more eager to consume high carbohydrate and high fat foods in the luteal phase (Tarasuk and Beaton, 1991; Danker-Hopfe *et al.*, 1995; Li *et al.*, 1999). These changes may cause an increase in energy intake and may lead to weight gain or fail of a weight loss program.

Based on the available evidence, change in appetite regulation occurs during the menstrual cycle. This change in appetite has been related to glucose homeostasis which may be an important determinant of eating behavior in women during menstrual cycle (Bisdee *et al.*, 1989). Therefore, increases in carbohydrate, fat and protein consumption during the luteal phase may be reflected from a general increase in appetite (Abraham *et al.*, 1981; Martini *et al.*, 1994). Carbohydrate craving especially chocolate cravings seems to be more frequent in the luteal phase than any other time of menstrual cycle (Rozin *et al.*, 1991; Hetherington and MacDiarmid, 1993; Li *et al.*, 1999).

Also, women tend to consume high-fat food in the luteal phase (Johnson *et al.*, 1994; Pelkman *et al.*, 2001). These could result in an excessive intake of calories during luteal phase and consequently affect weight (Davidsen *et al.*, 2007). In present study body weight increased slightly during the three days before beginning of the menstruation (end days of luteal phase), although this increase was not statistically significant. This finding is in accordance to previous studies. Although, we did any mention about their dietary food intake during menstrual cycle.

In conclusion, the menstrual cycle should be taken attention as a factor in the physiology of energy balance and weight change in premenopausal women. Increasing energy intake and food cravings, particularly for high carbohydrate and high fat foods, in the luteal phase may lead to weight gain and may fail the outcome of a weight loss programs. Considering these changes during woman's menstrual cycle may help to enhance efficacy of weight loss program and to improve adherence of weight management programs. So, further longitudinal studies among overweight and obese women are required. It is also suggested that future studies may need to broaden the age range of the participants and monitor dietary habits and energy intake.

ACKNOWLEDGMENTS

The source of data used in this study was from a research project and financial support was provided by Ahvaz Jundishapur University of Medical Science (Grant No. D-88019). We also would like to thank the participants of our study for their enthusiastic support.

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