Original article

Change in women’s eating habits during the menstrual cycle

Modification du comportement alimentaire de la femme au cours du cycle menstruel

Ines Kammoun *, Wafa Ben Saâda, Amira Sifaou, Emna Haouat, Hajer Kandara, Leila Ben Salem, Claude Ben Slama

Service d’endocrinologie et des maladies métaboliques, Institut national de nutrition et des technologies alimentaires, 11, street Jebel Lakhdhar, 1007, Bab Saadoun, Tunis, Tunisia

Abstract

Objectives. – During the menstrual cycle, the influence of hormonal variations on dietary habits in women has been suggested by several studies. In this context, our work aimed to assess the spontaneous food intake and the anthropometric parameters of women at different periods of their menstrual cycles. Methods. – This prospective study included 30 healthy women with regular periods (28 to 30 days), aged between 18 and 45. We assessed the spontaneous food intake and the anthropometric measurements (weight and waist circumference) of the participants, during the follicular, peri-ovulatory and luteal phases of their menstrual cycles. Results. – Our results showed a slight but significant increase in body weight during the luteal phase (P = 0.022) and the follicular phase (P = 0.017) compared with the peri-ovulatory phase, without any significant change in waist circumference. The caloric intake increased during the peri-ovulatory (P < 0.001) and the luteal phases (P < 0.001), compared with the follicular phase, with a significant increase in carbohydrate (P < 0.001), lipid (P = 0.008) and protein (P = 0.008) intake. Conclusions. – Our study showed a significant decrease in women’s weight during the peri-ovulatory phase, with a significant increase in caloric intake during the luteal phase of the menstrual cycle. Divergent results have been reported by other authors and the physiopathology of these changes is still poorly understood.

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Keywords: Eating habits; Weight; Menstrual cycle; Women

Résumé

Objectifs. – L’influence des variations hormonales durant le cycle menstruel sur le comportement alimentaire des femmes a été suggérée par plusieurs études. Les objectifs de notre étude étaient d’évaluer et de comparer l’apport alimentaire spontané ainsi que les paramètres anthropométriques des femmes durant les différentes phases de leurs cycles menstruels. Méthodes. – Étude prospective concernant 30 femmes bien portantes, bien réglées (cycles menstruels réguliers de 28 à 30 jours), âgées de 18 à 45 ans. Nous avons évalué l’apport alimentaire spontané, le poids et le tour de taille de ces participantes durant les 3 phases d’un même cycle menstruel (phase folliculaire, péri-ovulatoire et lutéale). Résultats. – Nous avons noté une augmentation modérée mais significative du poids durant la phase lutéale (p = 0,022) et la phase folliculaire (p = 0,017) par rapport à la phase péri-ovulatoire, sans variation significative du tour de taille. L’apport alimentaire spontané augmentait durant les phases péri-ovulatoire (p < 0,001) et lutéale (p < 0,001) en comparaison de la phase folliculaire, avec une augmentation significative des apports en glucides (p < 0,001), en lipides (p = 0,008) et en protides (p = 0,008). Conclusions. – Notre étude a montré une diminution significative du poids durant la phase péri-ovulatoire, avec augmentation des apports alimentaires pendant la phase lutéale du cycle menstruel chez les femmes. Des résultats divergents ont été rapportés par d’autres auteurs. La physiologie des liens entre le cycle menstruel et l’alimentation de la femme est encore mal élucidée.

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Mots clés : Habitudes alimentaires ; Poids ; Cycle menstruel ; Femme

1. Introduction

Food intake is influenced by neurochemical, hormonal, physiological and psychological factors. Several studies have shown significant variations in appetite and in energy intake in women during their menstrual cycles [1–4].

* Corresponding author.

E-mail address: ines.kammoun@planet.tn (I. Kammoun).

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These variations are in part explained by the influence of estrogen and progesterone on gastric emptying and on the secretion of some gastrointestinal hormones such as glucagon-like-peptide-1 (GLP-1) and cholecystokinin (CCK), which are important factors for the regulation of appetite and energy intake [1]. In this context, we conducted this prospective study, whose objectives were:

- to evaluate spontaneous food intake by women during the follicular, the peri-ovulatory and the luteal phase of their menstrual cycles;
- to compare women’s intake of food as well as their weight and waist circumference during the three phases of their menstrual cycles.

2. Subjects and methods

It was a prospective study that included 30 healthy women. All the participants had given their informed consent to participate in the study.

2.1. Inclusion criteria

- Age between 18 and 45 years old;
- regular periods (28 to 30 days).

2.2. Exclusion criteria

- Women on hormonal contraception or corticosteroid treatment;
- pregnant or lactating women;
- a personal history of serious diseases that may affect eating habits: neoplasia, neurological impairment, anorexia nervosa, renal, hepatic, respiratory or cardiac diseases;
- a personal history of endocrine or metabolic diseases.

2.3. Study design

Each woman included in the study was followed for a whole menstrual cycle (28 to 30 days), using a pre-established form. Three visits were planned for each participant:

- first visit: in the early follicular phase (between day 1 and day 3 of the menstrual cycle);
- second visit: in the ovulatory phase (between day 12 and day 16);
- third visit: in the late luteal phase (premenstrual period = 1–3 days before anticipated menstruation, based on self-reported historical cycle data).

On each visit, the participants had:

- a dietary survey: recorded by a qualified dietician, in order to estimate the total caloric intake and the distribution of macronutrients (carbohydrates, lipids, proteins). Photos of plate were used to achieve food investigation;
- a measurement of their anthropometric parameters (weight and waist circumference). The waist circumference was measured (in cm), using a measuring tape, midway between the iliac crests and the last costal margin.

2.4. Data analysis

Data analysis was performed using the following software:

- Bilnute 3: for the dietary surveys (to calculate the total energy intake, carbohydrate, protein and lipid intake on each visit);
- SPSS version 11.5: for statistical analysis. The numerical results are given as mean ± standard deviation and the qualitative results as percentages. The comparative statistical analysis used:
  - the Student’s t-test for continuous variables, and in case of low number, the nonparametric Mann-Whitney test,
  - the Chi² test for discontinuous variables and in case of non validity of this test (and comparison of 2%), the Fisher bilateral exact test.

P-values lower than 0.05 were considered as statistically significant.

3. Results

3.1. General characteristics of the participants

Our study included 30 participants: 23 unmarried (76.7%) and 7 married women (23.3%). Their ages varied from 18 to 43 (mean age: 27.1 ± 7.8 years).

The age of menarche varied between 11 and 14 years with a mean age of 12.4 ± 0.9 years.

3.2. Changes in anthropometric measurements during the menstrual cycle

The initial body mass index of our participants in the follicular phase was 25.6 ± 5.2 kg/m² (20.3–32.8 kg/m²).

The average weight was significantly higher during the late luteal phase (P = 0.022) and at the follicular phase of the menstrual cycle (P = 0.017) than in the peri-ovulatory phase (Fig. 1).

![Fig. 1. Weight changes during the menstrual cycle.](image-url)
Table 1
Involvement of each macronutrient in total caloric intake increasing between follicular, ovulatory and luteal phases.

<table>
<thead>
<tr>
<th>Macronutrients</th>
<th>Follicular vs ovulatory phase</th>
<th>Follicular vs luteal phase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Carbohydrates</td>
<td>Fat</td>
</tr>
<tr>
<td>Involvement in total caloric intake increasing (%)</td>
<td>56</td>
<td>36</td>
</tr>
</tbody>
</table>

![Fig. 2. Total caloric intake changes during the menstrual cycle.](image)

However, the mean waist circumference remained unchanged during the menstrual cycle: 77.6 ± 8.8 cm in the follicular phase, 77.6 ± 9.2 cm in the peri-ovulatory phase and 78.3 ± 9.5 cm in the luteal phase (P = NS).

### 3.3. Dietary survey data

Total caloric intake varied during the menstrual cycle (Fig. 2). It was significantly higher during the peri-ovulatory (2175.2 ± 321.8 Kcal/day) and luteal phases (2164.2 ± 290.3 Kcal/day) than in the follicular one (1688 ± 332 Kcal/day). This additional food intake interested carbohydrates as well as lipids and proteins. Thus, the carbohydrate intake increased significantly in the peri-ovulatory phase (315.7 ± 30.9 g/day vs 246.4 ± 26.8 g/day; P < 0.001) and in the luteal phase (309.5 ± 34.3 g/day vs 246.4 ± 26.8 g/day; P = 0.002) compared to the follicular phase (Fig. 3). We also found a significant increase in fat and protein intake in the peri-ovulatory phase (P = 0.008 for each, Fig. 3).

However, the additional food intake was more important for carbohydrates: 56% of total caloric intake increase in peri-ovulatory phase compared to follicular phase, and 53% of this increase in luteal phase compared to follicular phase were linked to carbohydrates intake (Table 1).

### 4. Discussion

Our study showed a significant increase in body weight during the luteal and the follicular phases, with a significant increase in caloric intake during the peri-ovulatory and the luteal phases of the menstrual cycle. Despite our small sample, our pilot study concerned healthy women in the general population. Our findings provide a basis on which we can rely to carry larger multicenter studies to better understand the relationship between food intake and menstrual cycle in women.

However, our study has some limitations. There was no measurement of fat and lean masses. On the other hand, there was no assessment of steroid’s plasmatic levels to be sure about the phase of the menstrual cycle. But all our participants had regular menses between 28 and 30 days.

We found a significant increase in women’s weight during the late luteal phase (P = 0.022) and the early follicular phase (P = 0.017) compared to the peri-ovulatory phase. Our results are consistent with those reported by previous authors [2] who suggest that excessive consumption of carbohydrates is the cause of weight gain in some women during the premenstrual period.

However, we did not find a significant variation in waist circumference during the different phases of the menstrual cycle. This parameter has not been studied by other authors. It seems that abdominal fat is not the factor that explains women’s weight variations during their menstrual cycles.

In our study, the total caloric intake was significantly higher during the peri-ovulatory and luteal phases (P < 0.001 for each
one) than in the follicular phase and it was especially a carbohydrate intake’s increase.

In fact, a cyclic variation of energy and macronutrient intake has been reported by several previous studies which showed that the most important changes were usually observed just before menstruation (late luteal phase) [2,5–7], with an increase in caloric intake of about 150 kcal per day in this period [5,6,8]. In the study by Tucci et al., the participants ingested approximately 15% more calories in the luteal phase [5]. It is important to note that, in this study, the eaten food was not composed of real meals but of snacks. This finding has implications on weight control [9]. The study of Bryant [10] showed that women consume about 100 kcal/day higher in the premenstrual phase compared to the rest of the cycle. According to these authors, a sustained supply of this amount of energy would result in a gain of approximately 5 kg of body weight over 12 months (assuming all other variables are constant) [10].

Similarly, the study by Pliner and Fleming showed that weight and food consumption were significantly higher during the luteal phase than during the follicular phase [11].

There are often dietary compulsions during this period of the cycle, especially for sweet foods and chocolate. According to Hormes and Rozin, the taste for chocolate is specifically related to the luteal phase in the menstrual cycle [12].

This could be explained by the change in ovarian hormones levels during the menstrual cycle. During the luteal phase, when both estrogen and progesterone increase, food intake increases, specifically sweet foods; in the follicular phase, with only increased oestrogen levels, food intake seems to decrease [2,13–17].

In addition, fluctuations in appetite, cravings and energy intake during the menstrual cycle may occur in parallel with cyclical rhythms in serotonin, which can be accompanied by affective symptoms like depression [18].

Our study showed a weight loss of 300 g during ovulation period in front of an increase food intake of 500 Kcal. This suggests that the daily energy expenditure may increase in the luteal [19]. However, this increment vary from one study to another, with important inter- and intra-individual variation. Thus, the simultaneous increase in the energy intake and energy expenditure can lead to a random variation of the weight. Also, this variation of 300 g may be often present many times within the menstrual cycle, but we do not have daily weight assessment in our work.

Analysis of the dietary surveys in our study showed a significant increase in fat and protein intake during the peri-ovulatory and late luteal phases compared to the follicular period. The significance of these results have been debated in the literature.

In 1989, Lyons revealed a significant decrease in protein intake during the ovulatory phase [20]. Also, in 2012, McNeil and Doucet [21] showed a decrease in the luteal phase. On the other hand, the study by Tarasuk and Beaton in 1991 showed an increase during the premenstrual phase [7].

Several studies have shown that fat intake tends to increase more during the premenstrual phase than in the rest of the cycle [17,18].

5. Conclusion

Our study showed a significant decrease in women’s weight during the peri-ovulatory phase, without any significant difference in waist circumference.

It also showed that there is a change in dietary habits during the menstrual cycle, with an increase in total caloric intake, carbohydrate, protein and fat intake in the peri-ovulatory and luteal phases. Thus, changes in dietary habits during the menstrual cycle should be taken into consideration in the interpretation of dietary evaluation in women.

The relationship between food intake and hormonal fluctuations during the menstrual cycle is very complex and involves several regulatory systems. The exact mechanisms are still poorly understood and require further investigations.

Disclosure of interest

The authors declare that they have no competing interest.

References


