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Original article

## Change in women's eating habits during the menstrual cycle

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

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#### 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. © 2016 Elsevier Masson SAS. All rights reserved.

**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. © 2016 Elsevier Masson SAS. Tous droits réservés.

**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].

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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:

- Bilnut 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  $\pm$  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  $\chi^2$  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:  $27.1 \pm 7.8$  years).

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

### 3.2. Changes in anthropometric measurements during the menstrual cycle

The initial body mass index of our participants in the follicular phase was  $25.6 \pm 5.2$  kg/m<sup>2</sup> (20.3–32.8 kg/m<sup>2</sup>).

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).

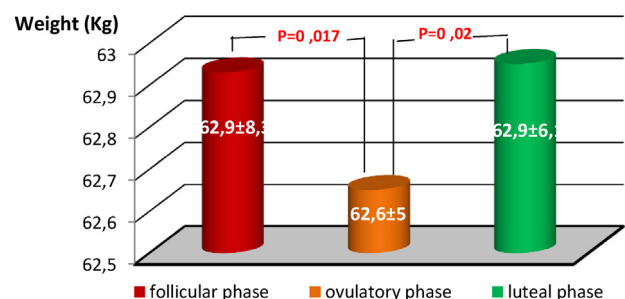


Fig. 1. Weight changes during the menstrual cycle.

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