Clinical Nutrition xxx (2015) 1–6

Contents lists available at ScienceDirect

Clinical Nutrition

journal homepage: http://www.elsevier.com/locate/clnu

Original article

Dietary intake, resting energy expenditure, and eating behavior in women with and without polycystic ovary syndrome

Ingrid Larsson [a], Lena Hulthén [b], Mikael Landén [c], Erik Pålsson [c], PerOlof Janson [d], Elisabet Stener-Victorin [e, f, *]

[a] Department of Endocrinology, Diabetology and Metabolism, Sahlgrenska University Hospital, 413 45 Gothenburg, Sweden
[b] Institute of Medicine, Department of Internal Medicine and Clinical Nutrition, Sahlgrenska Academy, University of Gothenburg, 40530 Gothenburg, Sweden
[c] Institute of Neuroscience and Physiology, Department of Psychiatry, Sahlgrenska Academy, University of Gothenburg, 40530 Gothenburg, Sweden
[d] Institute of Clinical Science, Department of Obstetrics and Gynecology, Sahlgrenska Academy, University of Gothenburg, 413 45 Gothenburg, Sweden
[e] Institute of Neuroscience and Physiology, Department of Physiology, Sahlgrenska Academy, University of Gothenburg, 40530 Gothenburg, Sweden
[f] Department of Physiology and Pharmacology, Karolinska Institutet, 171 77 Stockholm, Sweden

ARTICLE INFO

Article history:
Received 18 June 2014
Accepted 14 February 2015

Keywords:
Polycystic ovary syndrome
Body mass index
Resting metabolic rate
Respiratory exchange ratio
Dietary intake

SUMMARY

Background: Data on dietary intake, meal patterns, and eating attitudes from women with polycystic ovary syndrome (PCOS) is limited despite the fact that PCOS is associated with obesity. We aimed to test the hypothesis that women with PCOS display altered dietary intakes and eating behaviors compared to controls.

Methods: Women with PCOS (n = 72) as defined according to the modified Rotterdam criteria were compared with healthy controls (n = 30). Anthropometry included measurement of waist circumference and determination of the resting metabolic rate via indirect calorimetry. All women completed questionnaires regarding eating behavior; Three-Factor Eating Questionnaire (TFEQ-R21) and eating attitudes; Eating Attitudes Test (EAT). Group comparisons were done by Mann–Whitney U test and logistic regression analysis was used for adjustments of age and BMI in a non-parametric way.

Results: BMI was higher in women with PCOS compared to controls. Resting metabolic rate did not differ between women with women with and without PCOS after adjustment for age and BMI [1411 ± 229 kcal/day versus 1325 ± 193 kcal per day ($P = 0.07$)], whereas the respiratory exchange ratio was higher in women with PCOS than in controls [0.83 ± 0.07 versus 0.78 ± 0.08 ($P = 0.02$ after adjustments for age and BMI)]. Energy percent (E%) carbohydrates was higher in women with PCOS compared to controls ($P = 0.017$), but E% alcohol was lower ($P = 0.036$) after adjustment for age and BMI. The average total EAT scores and EAT dieting subscale scores were higher in women with PCOS compared with controls ($P = 0.001$ and $P = 0.024$, respectively) after adjustment for age and BMI. No difference was found for previous or current symptoms of bulimia nervosa.

Conclusions: Independent of BMI and age, the resting metabolic rate did not differ between women with and without PCOS indicating that women with PCOS should have equal abilities in terms of energy metabolism to lose weight as women without PCOS. Women with PCOS showed greater concerns about their weight and dieting, and this indicates that anxiety about weight is one of the psychological symptoms of PCOS.

1. Introduction

Polycystic ovary syndrome (PCOS) is the most common endocrine and metabolic disorder among women of reproductive age [1]. PCOS is characterized by hyperandrogenism, irregular menstrual cycles, infertility, and increased risk for pregnancy complications [2]. The most common metabolic features of PCOS are hyperinsulinemia and insulin resistance, and there is a strong

* Corresponding author. Department of Physiology and Pharmacology, Karolinska Institutet, Von Eulersväg 8, 171 77 Stockholm, Sweden. Tel.: +46 (0)705643655.
E-mail address: elisabet.stener-victorin@ki.se (E. Stener-Victorin).

http://dx.doi.org/10.1016/j.clnu.2015.02.006
0261-5614/

relationship between PCOS and obesity [1]. Both obesity and insulin resistance exacerbate the reproductive and psychological symptoms in women with PCOS [3,4].

Information about the dietary intakes and eating behaviors of women with PCOS is limited despite the fact that the syndrome is associated with obesity. Based on anecdotal evidence, women with PCOS appear to have difficulty with weight management. This could be explained by hyperinsulinemia and insulin resistance, which are common in both lean and overweight women with PCOS, that might predispose the women to weight gain via insulin's anabolic effects as well as from changes in energy expenditure and food intake [5]. In addition, high levels of androgens in women have been associated with more craving for carbohydrates [6], and this indicates the potential for increased energy intake in women with PCOS. This is supported by a study demonstrating that women with PCOS have higher energy intakes even though they have lower intakes of saturated fats and higher intakes of low glycemic index foods than women without PCOS [7]. Other studies have found no difference in carbohydrate intake between women with PCOS and controls but higher intakes of high glycemic index foods [8]. Contrary to these results, recent studies have demonstrated that the habitual dietary intakes of energy, fat, protein, and carbohydrates in overweight and obese women with PCOS do not differ from age-matched controls with somewhat lower BMIs [5]. Whether resting energy expenditure (REE) is altered in women with PCOS is unclear, and studies have shown both lower [9] and unaltered [10] REE in women with PCOS compared to healthy women.

Regular meal patterns have been shown to lead to higher postprandial energy expenditure, lower energy intake, and improved insulin sensitivity compared to irregular eating patterns in experimental studies of lean and obese women [11,12]. A recent study in premenopausal women concluded that meal pattern is an important factor that can explain the associations between eating behaviors and self-reported energy intake [13]. However, no previous study have investigated whether meal patterns of women with PCOS differ from those of healthy women. The one study that reported habitual meal patterns in women with PCOS did not include healthy women [14], thus the importance of the frequency of food intake in women with PCOS has yet not been determined. Eating attitudes might also be affected in women with PCOS, and it has been suggested that high androgen levels and polycystic ovaries might advance bulimic behavior by influencing food cravings and impulse control [15]. An increased frequency of PCOS among bulimic [16] and anorectic [17] women has been reported, although these associations have been questioned [18].

The lack of research indicates a clear need for further studies on dietary intakes, meal patterns, and eating attitudes in women with PCOS. In this work we explore these three associated areas in a case–control study of women with PCOS in Sweden. Our hypothesis was that women with PCOS display altered dietary intakes and eating behaviors compared to controls after adjustments for age and BMI.

2. Material and methods

This cross sectional case–control study was as conducted November 2005–September 2008 at the Sahlgrenska Academy, University of Gothenburg, Sweden. Participants were recruited by advertising in local newspapers and in frequently visited places in the community and have been described in detail elsewhere [19,20]. Potential participants for the study were asked to describe their medical histories and underwent a gynecological examination and a two-dimensional transvaginal ultrasonography (HDI 5000, ATL, Bothell, Washington) to determine ovarian morphology.

Modified Rotterdam criteria [21] was used to define women with PCOS. All women with PCOS should have ultrasound-verified polycystic ovaries (12 or more follicles 2–9 mm in diameter and/or ovarian volume ≥10 mL in at least on ovary) and/or clinical signs of hyperandrogenism (hirsutism, acne) and/or oligo/amenorrhea [21]. A Ferriman–Gallwey score ≥8 was used to define hirsutism. An confirmatory response to the question: *Do you have excessive acne*? defined acne. An intermenstrual interval >35 days or <8 menstrual bleedings in the past year defined oligoamenorrhea. Amenorrhea was defined as an absence of menstrual bleeding within the past 90 days. Women diagnosed with congenital adrenal hyperplasia, hypothyroidism, hyperprolactinemia, Cushing's syndrome, androgen secreting tumors, or other related disorders were excluded [21]. Control women were excluded if they had menstrual irregularities, evidence of polycystic ovarian morphology, or signs of hyperandrogenism. All women who reported pharmacological treatment within the past 12 weeks, breast-feeding within the past 24 weeks, or physical diseases such as hypertension or type 2 diabetes or ongoing medication for psychiatric disease, were also excluded. In total, 72 women with PCOS and 30 control women were included.

All participants gave oral and written informed consent. The study was conducted at the Sahlgrenska Academy, University of Gothenburg, Sweden, in accordance with the Declaration of Helsinki and was approved by the Institutional Review Board (IRB) and Regional Ethical Review Board of the University of Gothenburg.

2.1. Anthropometrics

After screening all participants with an initial examination, body weight (to the nearest 0.1 kg) and body height (to the nearest 0.5 cm) were measured with light clothing and without shoes. BMI was calculated as kg/m^2. Waist circumference (to the nearest 0.5 cm) was measured halfway between the lower rib and iliac crest, and hip circumference (to the nearest 0.5 cm) was measured at the widest point between the waist and thighs. The waist-to-hip ratio (WHR) was calculated as the ratio of the waist and hip circumferences.

2.2. Resting metabolic rate

After an overnight fast, the resting metabolic rate (RMR) was measured by indirect calorimetry using a Deltatrack™ II Metabolic Monitor ventilated hood system (Datex, Helsinki, Finland). Before measurement, the equipment was calibrated with Quick Cal™ calibration gas (Datex-Ohmeda, Helsinki, Finland) constituting of 95% O_2 and 5% Co_2 according to the manufacturer's instructions with gas mixtures of known O_2 and CO_2 concentrations. Participants were instructed to limit their physical activity the evening before the measurement. After 30 min of rest in a supine position, RMR was measured over the course of 30 min in a room with a temperature between 22 °C and 23 °C. The presented mean RMR for each participant is from the last 25 min of measurement. The respiratory exchange ratio (RER), also known as the respiratory quotient, is the ratio between volumes of released CO_2 and consumed O_2 from the oxidation of substrate. The size of the RER depends on what type of fuel (glucose, fatty acids, or protein) is being oxidized. The carbon and oxygen contents of these three substrates differ, and this affects the RER. There is a fourth fuel – alcohol – that is completely oxidized when consumed.

2.3. Dietary history including dietary intakes and meal patterns

This dietary assessment consisted of a detailed questionnaire that had previously been validated against the doubly labeled water technique, and this method of establishing a dietary history has been found to be a valid way to assess habitual energy intake [22]. All dietary data were collected at Sahlgrenska University Hospital.

Please cite this article in press as: Larsson I, et al., Dietary intake, resting energy expenditure, and eating behavior in women with and without polycystic ovary syndrome, Clinical Nutrition (2015), http://dx.doi.org/10.1016/j.clnu.2015.02.006