

POLYCYSTIC OVARY SYNDROME (PCOS) – PILOT STUDY ON DIET QUALITY

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Summary

Introduction: Polycystic Ovary Syndrome (PCOS) is a complex gynecological and endocrinological disorder affecting 6% to 21% of reproductive age women. The main characteristics of PCOS include hyperandrogenism, irregular menstrual cycles, lack of ovulation, enlarged ovaries with numerous cysts and infertility. Symptoms vary widely between women, but most commonly include obesity, hyperinsulinemia and insulin resistance (approximately 65% to 70% of women with PCOS). Therefore, uniform therapy and dietary recommendations fail.

Objective: The objective of this study was to analyze the quality of diet and dietary patterns of women with PCOS. Actual lifestyle habits and the diet of the women with PCOS have not been extensively researched internationally and never in Croatia.

Methods: The study included women of reproductive age diagnosed with PCOS (N=12), recruited at the Gynecological Office Lončar, Karlovac, Croatia. Study participants completed a general questionnaire on socio-economic characteristics and two questionnaires regarding their gynecological health and PCOS symptoms. Anthropometry was measured (Seca) while biochemical data was provided by the gynecologist. Diet quality was assessed with a 24-hour dietary recall and quality of diet and exercise habits were assessed with a questionnaire developed specifically for this study.

Results: Women with PCOS had an average daily energy intake of 82.3% of the RDA, i.e. 2333 kcal/day. When analyzing the contribution of separate macronutrients to that daily energy intake, discrepancies from the recommendations were found. The main discrepancies are high contribution of fats (40.1%) and increased intake of proteins (17.7%). Total fat intake showed a statistically significant positive correlation with waist circumference and waist to hips ratio. In addition, a statistically significant correlation was found between age and intake of total carbohydrates and plant proteins.

Conclusion: Study findings show the potential for a larger-scale study on Croatian women with PCOS.

Keywords: Polycystic Ovary Syndrome, diet, dietary habits

Introduction

Polycystic Ovary Syndrome (PCOS) is a complex endocrine condition with 6% to 21% prevalence in the population of the reproductive age women (Goss et al., 2014; Moran et al., 2013a; Graff et al., 2013). The main characteristics of PCOS are endocrine (hyperandrogenism) and biochemical abnormalities, irregular menstrual cycles, lack of ovulation, increased ovaries with numerous cysts and infertility (Lucidi, 2014; Moran et al., 2013b; Escott-Stump et al., 2012; Lim et al., 2012; Abercrombie et al. 2010). This disorder is accompanied by obesity, hyperinsulinemia and insulin resistance (Escott-Stump et al., 2012; Teede et al., 2007), but symptoms differ between women (Spritzer, 2014; Cronin et al., 1998). Beside medications, the main treatments for PCOS are weight reduction (Lucidi, 2014; Moran et al., 2013a; Moran et al., 2013b) and lifestyle management practices with equal therapy for obese and non-obese patients (Marsh et al., 2005).

Actual lifestyle habits and the diet of the women with the PCOS have not been extensively researched. Nevertheless, a relatively small number of studies show that these women, compared with their healthy counterparts, consume larger quantities of high glycemic index (GI) foods (Altieri et al., 2013; Graff et al., 2013; Moran et al., 2013b; Douglas et al., 2006). Other researchers have found that PCOS itself, increased energy intake, intake of high GI foods, lower physical activity and some other variables are all independently associated with higher BMI (Moran et al., 2013b).

Until today, only a few studies dealt with the lifestyle and diet interplay involved in PCOS development. None of these studies were performed in Croatia. Therefore, the main aim of this pilot study was to determine the diet quality and dietary patterns of women with PCOS in North West Croatia and subsequently to determine the potential for a larger scale study that could be used as a basis for an intervention study on women with PCOS.

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Subjects and methods

Study Participants and Study Protocol

A total of 12 women of reproductive age (aged 18-39) with PCOS diagnosed by the gynecologist (Gynecological Office Lončar, Karlovac, Croatia) were recruited, in a period of 6 months. After recruitment, each woman filled "The Survey on the Basic Data, Dietary Habits, and Physical Activity", and "The Questionnaire on the Polycystic Ovary Syndrome" (adapted according to Cronin et al., 1998). The Survey on the Basic Data, Dietary Habits, and Physical Activity" investigated the following: basic data (age, socio-economic data, anthropometrical data, etc.), dietary habits (number of meals per day; place of consumption; desire to experiment with food; food preferences; eating after feeling satiety; eating breakfast; eating dinner; consumption of dairy products, fruits and vegetables, potatoes, meat, fish, salt, fast food, candy, water, juices, coffee, sugar, alcohol, and dietary supplements) and degree of physical activity (during working time, during sport, and during free time). Research was conducted at Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek, Department of Food and Nutritional Research laboratory. Medical documentation on the history and course of the disease for the women diagnosed with PCOS was provided by the gynecologist (Gynecological office Lončar, Karlovac, Croatia). The study protocol was approved by the Ethical Committee for the Research on People from the Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek. Subjects were informed in detail about the study and written consent was obtained from all the participants.

Anthropometry Methods

Women recruited for the study were measured for body weight with a Tanita BC-601 (Tanita Corporation, Japan) scale (± 0.1 kg), body height without shoes with the position of the head in the Frankfurt plane (± 0.1 cm) with portable stadiometer Seca 123 (Seca, Germany) and waist and hip circumferences with measuring tape NCD Medical / Medical Prestige (Prestige Medical, USA). Their body mass index (BMI) was calculated with measured weight and height data. BMI was used to group all the women in one of the following categories: underweight ($\text{BMI} < 18.5 \text{ kg/m}^2$), normal (18.5 to 24.9 kg/m^2), overweight (25.0 to 29.9 kg/m^2) and obese (30.0 to $> 40.0 \text{ kg/m}^2$) (Lee and Nieman, 2010).

Diet Quality Assessment Method

The assessment of the dietary intake was performed with the 24-Hour Diet Recall, conducted with the "multi-pass protocol". This method was selected due to its convenience and because it showed the smallest error in terms of underestimating or overestimating nutritional intake (Scagliusi et al., 2008). Nutritional intake of macro and micronutrients was calculated by processing data from the 24-Hour Recall with a computer program "NutriPro" (Faculty of Food Technology Osijek, Croatia) that uses Croatian tables on the composition of foods and beverages (Kaić-Rak and Antičić, 1990). The results obtained were compared with the "Recommended Daily Allowance" (RDA) values (USDA, 2010).

Statistical Analysis

The chosen level of significance was $p=0.050$. Categorical variables were presented as absolute and relative frequencies while the numerical data were presented with the use of descriptive statistical methods, that is, mean and standard deviation. A Chi-square test was used to compare categorical variables within and between the groups. The differences between the two dependent groups were tested with the t-test for dependent measurements, that is, with using the t-test for independent measurements in the groups and the variables. An analysis of variance was performed with ANOVA. The Pearson correlation test was used for calculating the correlation of the numerical data.

Results and discussion

Mean BMI of the subjects was $27.4 \pm 8.5 \text{ kg/m}^2$ with mean waste hip ratio (WHR) of 0.9 ± 0.2 , which is not unusual for women with a PCOS diagnosis.

Responses to the "Survey on the Basic Data, Dietary Habits, and Physical Activity" showed that women with PCOS have a tendency towards higher GI foods (for example: 33.3% women with PCOS eat cakes/sweets every day, 33.3% women with PCOS eat bakery products with dinner, 16.6% women with PCOS never put additional sugar in their food/beverage), which corresponds to previous research on this topic (Altieri et al., 2013; Graff et al., 2013; Moran et al., 2013b; Douglas et al., 2006). When it comes to physical activity subjects were mostly sedentary.

The total daily energy intake of analyzed women was calculated as the percentage of the RDA intake based on the nutritional requirements for women of reproductive age. In this study, subjects had an

average daily energy intake of 82.3% of the RDA, i.e. 2333 kcal/day. Graff et al. (2013) and Moran et al. (2013b) found that women with PCOS have a higher calorie intake than women who do not suffer from

PCOS. However, women with PCOS in this study had higher total daily energy intake than Croatian healthy women of reproductive age in the study by Banjari (2012).

Table 1. Total energy intake per subject with percentage of RDA and distribution of energy intake by macronutrient

Subject	Total daily energy (kcal)	Energy % of RDA	Protein % in total energy	Fat % in total energy	CHO % in total energy
1	1702	72.9	25.6	35.0	40.8
2	1622	69.5	12.4	46.2	41.8
3	684	29.3	24.5	47.0	30.4
4	1278	54.8	16.5	31.7	52.7
5	4118	176.5	16.9	47.6	35.8
6	2714	116.3	14.0	39.4	47.2
7	2405	103.1	15.1	26.0	61.3
8	1455	62.4	10.0	44.9	46.8
9	1536	65.9	19.5	47.7	33.6
10	1022	43.8	21.1	33.6	45.4
11	2513	107.7	16.4	47.8	37.5
12	1978	84.8	20.0	34.1	48.4
Average	1919	82.3	17.7	40.1	43.5

RDA – Recommended Daily Allowance; CHO – carbohydrates

When analyzing the contribution of separate macronutrients to daily energy intake (Table 1), discrepancies from the recommendations (USDA, 2010) were found. The main discrepancies were high contribution of fats (40.1%) and increased intake of proteins (17.7%) (Fig. 1), both involved in abdominal obesity and pancreatic functioning, i.e. insulin secretion, which consequently can result in PCOS (Escott-Stump et al., 2012; Teede et al., 2007). It is interesting to note that the contribution of separate

macronutrients to the total daily energy intake differ significantly from the one reported by Banjari (2012) for Croatian women of reproductive age. Banjari (2012) found that for healthy women of reproductive age in Croatia contribution of macronutrients is as follows: 51.0% from carbohydrates, 12.6% from proteins, and 35.9% from fats. On the other hand, Altieri et al. (2013) did not find a difference in macronutrients and energy intake between healthy women and women with PCOS.

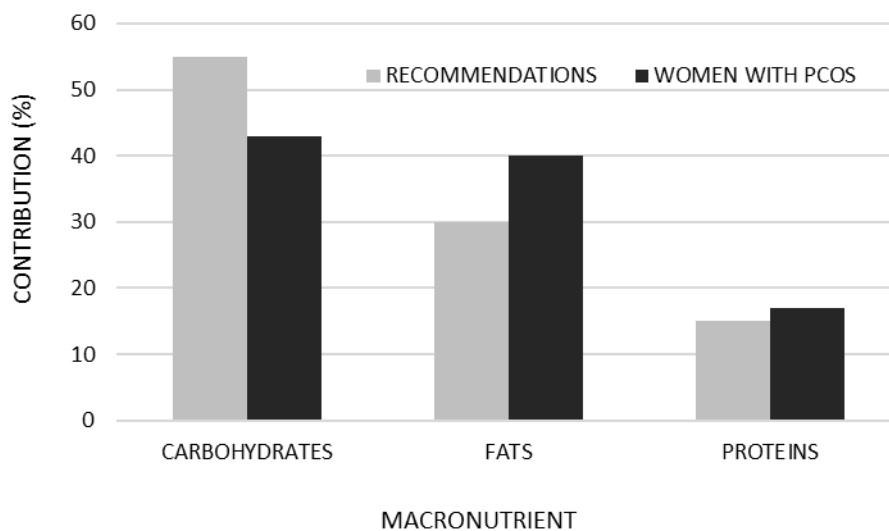


Fig. 1. Contribution of separate macronutrients to the total daily energy intake of women with PCOS as compared to the recommendations (US Department of Agriculture and US Department of Health and Human Services 2010)

Total fat intake showed a statistically significant positive correlation with higher levels of abdominal fat, as measured by waist circumference and waist to hips

ratio (Table 2). Abdominal fat can result in insulin resistance, which is instrumental in the etiology of PCOS (Escott-Stump et al., 2012; Teede et al., 2007).

Table 2. Correlation of Selected General and Socio-Economic Variables with Energy and Fat Intake Based on a 24-Hour Dietary Recall

Selected variable	kcal	Fat total	SF	MUFA	PUFA	Linoleic acid	Chol
Age	0.56	0.44	0.44	0.38	0.42	0.46	0.43
Household members	-0.26	-0.13	-0.23	-0.12	-0.23	-0.25	-0.45
Smoking	-0.47	-0.38	-0.43	-0.38	-0.34	-0.34	-0.29
BMI	0.44	0.50	0.36	0.39	0.28	0.28	-0.17
Waist (W)	0.55	0.62*	0.49	0.50	0.42	0.42	-0.12
Hips (H)	0.42	0.49	0.37	0.39	0.35	0.35	-0.08
W/H ratio	0.53	0.59*	0.47	0.47	0.39	0.38	-0.17

*statistical significance at $p < 0.05$, the Pearson correlation test

SF–saturated fats; MUFA–monounsaturated fats; PUFA–polyunsaturated fats; Chol–cholesterol

In addition, a statistically significant correlation was found between age and intake of total carbohydrates and plant proteins (Table 3). Thus, according to these results, as women with PCOS get older they show an increased tendency towards higher consumption of carbohydrates and plant proteins. Moreover, distribution of age and BMI showed that BMI increased with age (six subjects aged 18-26 had mean BMI of 24.5 ± 7.9 kg/m² and six subjects aged 29-39 had mean BMI of 30.4 ± 8.7 kg/m²). This suggests

that, some age groups of women with PCOS in Croatia, when trying to lose weight in an attempt to control PCOS symptoms, should focus on reducing consumption of total carbohydrates and plant proteins. Moreover, if results from the “Survey on the Basic Data, Dietary Habits, and Physical Activity” are taken into account, these women should focus on reducing high GI foods (mainly simple carbohydrates) and increasing their physical activity (improving cellular metabolism of glucose).

Table 3. Correlation of Selected General and Socio-Economic Variables with Protein and Carbohydrate Intake Based on a 24-Hour Dietary Recall

Selected variable	Protein total	Plant protein	Animal protein	CHO total	CHO simple	CHO complex	CHO fiber
Age	0.50	0.61*	0.43	0.61*	0.49	0.51	0.55
Household members	-0.19	-0.35	-0.13	-0.41	-0.56	-0.33	-0.49
Smoking	-0.48	-0.42	-0.41	-0.49	-0.47	-0.44	-0.52
BMI	0.17	0.43	-0.00	0.37	0.28	0.29	0.30
Waist (W)	0.24	0.51	0.05	0.46	0.36	0.37	0.39
Hips (H)	0.16	0.40	0.01	0.33	0.26	0.24	0.29

*statistical significance at $p < 0.05$, the Pearson correlation test, CHO– carbohydrates, BMI – body mass index

Study results indicated a potentially negative correlation between the number of household occupants and smoking with the intake of macronutrients. For women with higher number of household members negative correlations showed that more time spent in care for others (especially children and elderly) resulted in lower daily intake of energy (and all macronutrients; Tables 2 and 3). In addition, a negative correlation between smoking and daily intake of energy (and all macronutrients; Tables 2 and 3) showed that, as expected, smokers eat less. When asked, 50% of women participating in the study expressed their interest in involvement in a

prospective study with dietary intervention if it could change the course and symptoms of their PCOS. This shows the potential for educational intervention on women with PCOS about the PCOS symptoms and weight gain, especially around waist.

The main limitation of the study is the low number of participants. Thus, we believe that inclusion of a larger number of women with PCOS might have resulted in different statistical significance for some or all of the identified parameters that showed a potential influence on the overall diet quality and the symptoms of PCOS in Croatian women.

Conclusions

The discovered discrepancies with dietary recommendations when it comes to macronutrient intake, correlations between socio-economic circumstances and macronutrient intake and tendency towards high GI foods on this small sample indicate that there is a potential for a larger scale study of dietary patterns in Croatian women with PCOS.

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Conflict of interest statement

None declared.

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