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**INGESTÃO DIETÉTICA, COMPOSIÇÃO CORPORAL E PARÂMETROS
METABÓLICOS DE MULHERES COM SÍNDROME DO OVÁRIO POLICÍSTICO**

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Trabalho de Conclusão de Residência apresentado à Universidade Federal de Uberlândia, como parte das exigências do Programa de Residência em Área Profissional da Saúde para obtenção do título de especialista em Nutrição Clínica.

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DIETARY INTAKE, BODY COMPOSITION AND METABOLIC PARAMETERS IN WOMEN WITH POLYCYSTIC OVARY SYNDROME

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Abbreviations: PCOS, Polycystic Ovary Syndrome; BMI, Body Mass Index; DXA, Dual-energy X-ray absorptiometry; HOMA-IR, Homeostasis Model Assessment-estimated Insulin Resistance; OGTT, Oral Glucose Tolerance Test.

Abstract

Background & aims: Overweight polycystic ovary syndrome (PCOS) patients present exacerbation of clinical symptoms and increased risk for chronic diseases. The effects of inadequate dietary intake have been investigated in body weight gain in PCOS women. The aim of this study was to evaluate the dietary pattern and to analyze possible associations with the metabolism and body composition in PCOS women.

Methods: A case-control study was performed with thirty-nine women diagnosed with PCOS and thirty-five control women, matched by age and body mass index. A body composition assessment was performed by Dual-energy X-ray absorptiometry (DXA) and food intake was assessed using the seven-day food record. The metabolic parameters evaluated were fasting glucose, insulin, Homeostasis Model Assessment-estimated Insulin Resistance (HOMA-IR) index and oral glucose tolerance test (OGTT).

Results: No significant differences were observed in dietary intake of women with or without PCOS. In the analysis of the associations between dietary intake, metabolic parameters and body composition, PCOS women showed an inverse correlation between dietetic fiber intake and HOMA-IR index ($p=0.024$; $r=-0.365$). Also in PCOS group, dietary fiber intake presented an inverse correlation with total body fat ($p=0.011$, $r=-0.401$), trunk fat ($p=0.015$, $r=-0.388$), and android fat ($p=0.006$; $r=-0.431$). PCOS women group had higher glucose 120', compared to those without PCOS ($p=0.015$)

Conclusion: These results provide evidence that the adequate intake of dietary fiber contributes to more appropriate body composition and glucose metabolism in PCOS women and possibly toward the prevention of chronic non-communicable diseases.

Keywords: Polycystic ovary syndrome; Dietary pattern; Body composition; Dual-energy X-ray absorptiometry; Metabolic parameters.

1. Introduction

Polycystic ovary syndrome (PCOS) is a common endocrine disease. PCOS affects 4 to 8% of women during reproductive age through the criteria put forward by the *National Institutes of Health (NIH)* or 14% to 19% in line with the *European Society of Human Reproduction and Embryology and the American Society for Reproductive Medicine (ESHRE/ASRM)*^{1,2,3,4}. Although the responsible causal factors for the development of PCOS are still not totally clear, some researchers have demonstrated the involvement of genetic and environmental factors^{5,6,7,8}.

PCOS is essentially characterized by the presence of physiopathological alterations typical of metabolic syndrome, with emphasis placed on insulin resistance and hyperinsulinemia^{3,9}. The presence of these dysfunctions increases the risk of developing type 2 diabetes and cardiovascular diseases, among other diseases associated with metabolic alterations¹⁰.

Specifically to body composition, women with PCOS present a high overweight ratio. Although there is no consensus reached in the literature^{11,12}, some investigators have demonstrated that patients with PCOS present an increase in central abdominal fat when compared to controls matched by body weight^{13,14}. According to Carmina et al.¹³, this difference was not observed when comparing obese PCOS and the obese control group, i.e., the increase of central abdominal fat is due to the differences found between the control group and the eutrophic or overweight PCOS patients¹³. Overweight PCOS patients, mainly those with central obesity, present less sensibility and elevated serum insulin levels, exacerbation of clinical symptomatology and a higher risk for chronic non-communicable diseases^{14,15,16}.

Inadequate food intake in qualitative and quantitative terms have been investigated as one of the casual factors responsible for the excess body weight in

women with PCOS¹⁷. In a study evaluating food intake by means of a semi-quantitative food intake questionnaire, it was demonstrated that women with PCOS present a higher total energy and fat consumption¹⁸. The aims of the present study were to characterize the dietary pattern and analyze possible associations between the consumption of specific nutrients with metabolic parameters and body fat distribution in women with PCOS.

2. Participants and Methods

2.1 Participants

This case-control study was performed at the Endocrine Gynecology Outpatient of the Clinical Hospital of Uberlandia, Federal University of Uberlandia, Brazil, between September 2015 to May 2017.

The study participants were recruited by means of pamphlets posted in strategic locations of the campus, email and verbal communication. Potential study participants were instructed to present their medical histories, as well as being submitted to a genealogical exam. In order to determine ovarian morphology, a two-dimensional pelvic or transvaginal ultrasound exam was performed.

Thirty-nine women were included in the study, all ranging between 18 and 35 years of age, and all diagnosed with PCOS, as they presented two or more criteria from the Rotterdam consensus¹⁹: oligomenorrhea and/or anovulation; clinical signs and/or biochemical hyperandrogenism; and/or polycystic ovaries on an ultrasound exam. Ovaries were characterized as polycystic through an ultrasound exam, and present one of the following alterations: 12 or more follicles measuring between 2-9mm in diameter or with increased ovary volume ($\geq 10 \text{ cm}^3$), on at least one of the ovaries²⁰. The presence of oligomenorrhea and/or anovulation was identified by the occurrence of the menstrual cycle with a duration of > 38 days²¹. Hyperandrogenism was identified through the presence of acne in the physical exam and/or hirsutism (score for Ferriman-Gallwey ≥ 8)²².

Thirty-five women were included in the control group, with ages between 18 and 35, all presented regular and spontaneous menstrual cycles and who did not present any previous history of infertility. All the women included in the control group were matched by age and Body Mass Index (BMI) with women with PCOS. In the clinical

practice, in order to perform the pairing, a difference of up to $\pm 2.0 \text{ kg/m}^2$ on the BMI was used as the criterion, while observing that each control had the same BMI category as the recruited PCOS patient (WHO, 2000)²³.

Immediately after the inclusion of the study participants, an anthropometric evaluation was performed and information was collected for the filling out of a semi-structured questionnaire. The collection of blood samples for performing biochemical exams (fasting glucose, basal insulin, and after glucose challenge test), and the body composition evaluation using the Dual-energy X-ray absorptiometry (DXA) were performed in specialized clinics at a later moment.

Were excluded from the study those patients that had been taking any kind of hormonal medication over the last three months, or oral hypoglycemic agents, or medication for inducing weight loss; those diagnosed with other endocrinological diseases (congenital adrenal hyperplasia, hypothyroidism or hyperthyroidism, hyperprolactinemia, Cushing's syndrome, androgen secreting tumors or other related disorders); pregnant women or breast feeding mothers.

All the participants of the study signed the term of free and informed consent. The study was conducted according to the guidelines established in the Declaration of Helsinki, after being approved by the Ethics Committee for Research on Human beings at the Federal University of Uberlandia.

2.2 Study protocol

A specific and semi-structured questionnaire was created with information pertinent to diet history, including preferences and food aversions, intolerances or food allergies, standards of chewing, habitual daily water intake and use of dietary supplements. In addition, were investigated the intestinal habits and the history of the

evolution for their body weight. General and sociodemographic information, along with personal history and family history were also registered.

2.3 Anthropometric evaluation

Were taken measurements for body weight, height, waist circumference (measured at the midpoint between the last costal arch and the iliac crest) and the circumference of the hip (measured along the largest diameter of the gluteal region). Following this, the BMI was calculated.

For body weight measurements, a digital scale was used (Welmy W300, precision of 0.1 kg). During the weighing process, the patient was barefoot, erect and stood in the center of the platform with her arms close to the body, eyes fixed at a point in front of her, and with the least amount carried objects as possible. The height measurement (precision of 0.5 cm) was taken on a vertical anthropometer coupled to the digital scale. The patient remained upright, barefoot, in the center of the platform with their back to the marker and heels together and their feet at an angle of 45 degrees. The patient kept their arms down and their head back, looking at a fixed point at eye height. The BMI was calculated by the formula: $\text{body weight (kg)} / \text{height (m)}^2$ and was classified according to references from the World Health Organization²¹. The value of the waist circumference was obtained from the average of three measurements taken with an inextensible anthropometric tape (*Sanny Medical*, SN-4010, precision of 0.5 cm) at the midpoint point between the last costal arch and the iliac crest arch. The hip circumference (precision of 0.5 cm) was measured in the region localized between the waist and the thighs, at the point of largest diameter.

2.4 Evaluation of body composition

The evaluation body composition was performed using DXA of the whole body (*Lunar Prodigy DXA System, software version 11.20*). After the removal of all metallic objects, a radiologist technician performed the exam. Measurements were made regarding the amount of fat body mass and lean body mass, along with the obtainment of information concerning the distribution of body fat in the android and trunk compartments. More specifically, were identified the compartments relevant to the android fat (lower limit: horizontal line connecting the upper anterior superior iliac spines; upper limit: defined as 20% above the lower border; lateral boundaries: waist margins parallel to the chin line) and the trunk fat (defined by a horizontal line below the chin and vertical lines passing through colli femori). Was calculated the ratio between the fat mass and lean mass (fat mass (%) / lean mass (%)).

2.5 Evaluation of food intake

The dietary pattern was determined by the seven-day food report²⁴. The participants were guided to fill in the time and place of meals taken, the quantity and the type of food or preparation and drinks ingested. At the moment of devolution of the food register, each described item was conferred with the patient in question. In accordance with the seven-day food report, the total energy ingested and the quantities consumed for carbohydrates, proteins, fat, saturated fatty acids, cholesterol and fiber were all identified.

2.6 Biochemical analyses

The blood samples used for performing the biochemical analyses were obtained after a 12-hour fasting. The serum levels of total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides (enzymatic colorimetric method, Roche Diagnóstica©,

Brazil) were evaluated. In addition, the simplified oral glucose tolerance test (OGTT) was performed, in two screenings, with the first in fasting and the second two hours after the ingestion of 75g of glucose. The serum blood glucose levels (hexokinase method Roche Diagnóstica©, Brazil) and of basal insulin (chemiluminescence, Roche Diagnóstica©, Brazil) were evaluated. The Homeostatic Model Assessment for Insulin Resistance (HOMA-IR) index was calculated using the formula: $\text{HOMA-IR} = \text{fasting glucose (mg/dL)} \times \text{fasting insulin (}\mu\text{UI/mL)} / 405^{25}$.

2.7 Statistical analysis

The statistical analysis was performed using the software SPSS version 21.0 (Armonk, NY: IBM Corp.). The results were represented as mean $\pm$ standard deviation (SD) in the case of parametric data and as the median and confidence interval (CI 95%) for non-parametric data. The Student t test was used for analyzing the anthropometric measurements (weight, height, BMI, waist and hip circumference) and the metabolic parameters (fasting glucose, basal insulin, HOMA-IR index and after glucose challenge test), and the body composition measurements (total fat, trunk fat, and android fat). The comparisons among the non-parametric results were carried out using the Mann-Whitney U test. Comparisons were made in order to identify if after the separation of the participants into specific subgroups, in accordance with the BMI classification proposed by WHO²¹, were maintained the interpretations referring to the dietary parameters (energy intake, carbohydrate, protein, lipid, saturated fatty acids, cholesterol and fiber) and the distribution of body fat (total fat, trunk fat, and android fat), using the test of *Kruskal-Wallis* (1-way ANOVA). The Spearman coefficient was used to analyze the correlations between energy intake and nutrients with the metabolic parameters and the body composition of women with and without PCOS.

Statistical significance was considered as $p \leq 0.05$, through the adoption of the two-tailed test.

3. Results

Anthropometric and some metabolic parameters of the PCOS and their BMI and age-matched control group were presented on Table 1. No significant differences were observed in weight, BMI, waist, hip, fasting glucose, fasting insulin, HOMA-IR index between the PCOS and control groups. The PCOS group had higher glucose 120', when compared to those without PCOS ($p=0.015$) (Table 1).

In relation to body composition, it was identified that total body fat, trunk fat, and android fat were similar in PCOS and control groups (Table 1). In the comparisons performed between the participants included in the PCOS subgroups eutrophic ($n=20$) and eutrophic control ($n=19$) ($BMI = 18.5$ to 24.9 kg/m^2); and overweight PCOS ($n=19$) and overweight control ($n=16$) ($BMI \geq 25.0 \text{ kg/m}^2$), it was demonstrated that total fat ($p=0.000$), trunk fat ($p=0.000$), and android fat ($p=0.000$) were higher in overweight women than eutrophic women, with ($p=0.000$) or without ($p=0.000$) PCOS.

The dietary pattern of eutrophic and overweight women with or without PCOS was presented on Table 2. No significant differences were observed in dietary intake of women with or without PCOS. Comparable results were observed in specific subgroups, i.e., eutrophic women subgroup and overweight women subgroup, with or without PCOS, had similar dietary patterns. Specifically in the PCOS group, for results expressed by kilogram of weight, it was identified that overweight women consumed less energy ($p=0.001$), carbohydrate ($p=0.012$), protein ($p=0.031$), fat ($p=0.047$) and fibers ($p=0.006$) than normal weight PCOS women. In the group without PCOS, for results expressed by kilogram of weight it was observed that overweight women consumed lower amounts of energy ($p=0.022$), protein ($p=0.004$) and cholesterol ($p=0.004$) than eutrophic women without PCOS.

There was a positive correlation between dietary protein ($p=0.037$; $r=0.359$), fat ($p=0.005$; $r=0.005$), saturated fatty acids ($p=0.022$; $r=0.022$) and fiber intake ($p=0.039$; $r=0.356$) with the after glucose challenge test of women without PCOS (Table 3). In the analysis of the associations between dietary intake, metabolic parameters and body composition, PCOS women showed an inverse correlation between dietary fiber intake and the HOMA-IR index ($p=0.024$; $r=-0.365$), i.e., the higher the fiber intake, the lower the HOMA-IR index value was observed in PCOS women. In addition, for a similar fiber intake in women with and without PCOS, the range of HOMA-IR index values is higher in PCOS than in control groups (Fig. 1A and 1B).

In PCOS group, dietary fiber intake presented an inverse correlation with total body fat ($p=0.011$; $r=-0.401$), trunk fat ($p=0.015$; $r=-0.388$), and android fat ($p=0.006$; $r=0.431$) (Table 3). The relationship between fiber intake and visceral adiposity (android fat) in both groups is shown in Fig. 1C and 1D.

4. Discussion

The present study demonstrated that women with PCOS present a negative correlation between the consumption of dietary fiber and resistance to insulin, i.e., the higher the consumption of fiber, greater will be the insulin sensitivity presented by the patient. The least resistance to the action of insulin associated with consumption of dietary fiber identified in basal conditions in women with PCOS is lost in time 120 minutes of the OGTT. These results permit the interpretation that to obtain a better metabolic control in PCOS women, they should be guided toward the regular daily consumption of the recommended quantities of dietary fiber (20 to 35 g/dia)²⁶, as well as the restriction in the consumption of sugar and sweet foods. It is important to highlight that these guidelines are included in the dietary recommendations for healthy individuals, elaborated by responsible organs from a number of countries²⁷, including the Alimentary Guide for the Brazilian Population, proposed by the Brazilian Ministry of Health²⁸.

Few researchers have investigated the relationship between food intake, metabolic parameters and body composition in women with PCOS. In the present study, it was demonstrated, exclusively for PCOS women, that dietary fiber intake is negatively associated with body composition, in particular in terms of central fat, i.e., a body composition parameter that has been specifically investigated in women with PCOS^{12,13,15}. In agreement with these results, Nybacka et al.²⁹ identified that the increase in the intake of dietary fiber in women with PCOS presents a negative correlation with the increase in BMI. According to these researchers, the increase in dietary fiber intake is a primary predictor to the reduction in the BMI.

In the present study, it was demonstrated that women with PCOS and investigated controls, presented a similar ingestion of energy, macronutrients,

saturated fatty acids, cholesterol and fiber. These results confirm those of previous studies that also did not identify differences in food consumption, between women with and those without PCOS^{30,31}.

In the specific analysis concerning food intake for the subgroups made up of overweight women and eutrophic women, with or without PCOS, it was identified that regardless of the diagnosis of PCOS, the participants from the overweight subgroups present lower energy and macronutrient food intake (expressed in kilocalories / kg of body weight), than the participants of the eutrophic subgroups. Several factors should be analyzed in an attempt to explain these results. Initially, it is necessary to consider that due to higher body mass, overweight patients may present a reduction in habitual physical activity, with a consequent decrease in daily energy expenditure³². Another possibility is that due to the alteration in body composition, with an increase in fat mass / lean mass ratio, there is a decrease in the metabolic rate and the daily energy needs, i.e., overweight patients may actually present a decrease in daily energy intake expressed in kilocalories / kg of current body weight³³. In addition, it is necessary to consider that although there exist many advantages to using the seven-day food report²³, those patients with excess weight, with or without PCOS, may have intentionally given an underreporting of food intake³⁴.

In the comparison with matched controls by BMI and age, the PCOS patients included in the present study showed similar values for the measurements taken using DXA for total fat, trunk fat, and android fat. All overweight patients, independent to being part of the PCOS group or not, presented a higher quantity of total body fat, trunk fat, and android fat. In addition, there were no differences identified in the body fat of eutrophic women, with or without PCOS. These results confirm those of previous studies that did not identify differences in the quantities and in the distribution of body

fat between women with PCOS and control groups¹¹. However, it is necessary to highlight that there still does not exist a consensus in the literature concerning this question. In disagreement with the results presented in this study, Carmina et al.¹³ identified that central abdominal fat was increased by 30% in eutrophic PCOS women and 71% in overweight PCOS women, in comparison to 50% of the control women without PCOS. Higher central fat mass in PCOS women compared with control groups was also demonstrated by Glinborg et al.¹⁵.

As particular strengths in this study, one can highlight the use of the seven-day food report, an instrument that presents higher accuracy in estimating habitual food intake of individuals. Another feature is the use of a variety of parameters for evaluating possible metabolic alterations, including the HOMA-IR index, as well as the use of the DXA for evaluating body composition. The limitations of the study are related to the observational study design, as it is not possible to attribute causality in the results found, although there were associations identified between the consumption of fiber, metabolic parameters and body composition in PCOS women. It is hoped that in future clinical studies, it will be the effect of consuming adequate dietary fiber on the metabolism and body composition of PCOS patients.

In conclusion, the systematic guidance toward the adequate consumption of dietary fiber, considering as source foods the fruits, leafy vegetables and grains, contributes to adequate body composition, the control of the glucose metabolism and possibly to the prevention of chronic non-communicable diseases in PCOS women.

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Statement of Authorship

N.B.C., C.T.R. and C.M.S. participated in the study design, statistical analyses, interpretation of data, and manuscript drafting. D.A.D.S. participated in the study design, interpretation of data, and critical revision of the manuscript for important intellectual content. A.C.J.R.S. participated in the study design, and critical revision of the final version of the manuscript. All authors approved the final version for submission.

Conflict of Interest Statement and Funding sources

None of the authors had any personal or financial conflict of interest.

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Table 1 Anthropometric, metabolic and body composition features of the study participants.

Variable	PCOS (n=39)	Controls (n=35)	<i>P</i> value
Age (y)	25.17±3.86	25.85±4.48	0.487
Weight (kg)	64.75 (63.73-74.87)	62.80 (62.25-76.22)	0.630
BMI (kg/m ²)	24.42 (24.74-29.34)	24.20 (24.37-29.15)	0.787
Waist (cm)	83.50 (82.00-93.15)	81.00 (79.24-90.21)	0.551
Fasting glucose (mg/dL)	86.66±8.46	85.29±7.71	0.462
Fasting insulin (μU/mL)	9.70 (10.53-17.48)	9.10 (8.37-13.08)	0.105
HOMA-IR	2.20 (2.27-3.80)	2.02 (1.77-2.83)	0.123
Glucose 120' (mg/dL)	103.86±23.61	90.48±16.90	0.015
Total body fat (%)	40.61±9.68	43.33±13.34	0.324
Trunk fat (%)	42.10±11.09	41.92±10.31	0.943
Android fat (%)	45.10±12.44	44.55±11.38	0.844

Data were represented as means ± standard deviation (SD) or median and 95% Confidence Interval (CI). Abbreviations: BMI: Body Mass Index; HOMA-IR: Homeostasis Model Assessment-estimated Insulin Resistance. Statistical comparisons were performed by Student *t* test for means and by Mann-Whitney *U* test for medians (*P* value ≤ 0.05).

Table 2 Dietary pattern of women with and without PCOS.

Variable	PCOS (n=39)				Controls (n=35)				<i>P</i> value
	Total	Eutrophic (n=20)	Overweight (n=19)	<i>P</i> value	Total	Eutrophic (n=19)	Overweight (n=16)	<i>P</i> value	
Energy (kcal)	1651.42 (1507.20-1975.50)	1683.64 (1518.22-2086.49)	1479.12 (1255.74-2038.16)	0.576	1565.64 (1509.45-2079.32)	1704.98 (1391.91-2303.88)	1428.77 (1330.46-2024.20)	0.574	0.909
Energy (kcal/kg)	23.56 (22.35-30.51)	29.00 (27.40-38.59)	19.01 (15.08-23.96)	0.001	22.77 (22.19-38.48)	31.42 (24.90-41.55)	19.38 (12.91-21.19)	0.022	0.935
Carbohydrate (g)	203.47 (176.39-241.48)	203.47 (177.73-269.04)	190.35 (144.95-239.53)	0.644	188.19 (166.98-257.81)	190.76 (140.13-278.68)	163.35 (148.30-270.64)	0.644	0.630
Carbohydrate (g/kg)	2.85 (2.74-4.07)	3.59 (3.17-5.11)	2.44 (1.77-3.49)	0.012	2.93 (2.44-4.01)	3.32 (2.48-5.11)	2.46 (1.78-3.32)	0.248	0.782
Carbohydrate (%)	49.22 (44.12-51.38)	49.93 (43.48-55.64)	48.14 (42.31-50.85)	0.247	47.34 (42.60-50.02)	46.37 (40.58-48.58)	49.51 (41.69-55.07)	0.247	0.426
Protein (g)	75.35 (71.09-97.83)	78.09 (67.67-103.48)	67.47 (60.13-102.41)	0.608	72.30 (66.87-95.78)	74.80 (64.54-114.61)	61.16 (58.89-79.74)	0.608	0.630
Protein (g/kg)	1.08 (1.03-1.84)	1.53 (1.23-1.88)	0.79 (0.52-2.10)	0.031	0.99 (0.99-1.51)	1.27 (1.18-2.02)	0.78 (0.72-0.95)	0.004	0.733
Protein (%)	18.43 (17.76-22.73)	17.54 (15.87-23.22)	20.52 (17.24-24.25)	0.539	17.20 (16.68-21.62)	18.98 (16.67-24.46)	16.41 (14.75-20.22)	0.539	0.577
Fat (g)	57.08 (50.14-73.63)	57.11 (47.09-78.57)	50.54 (40.65-77.74)	0.563	56.47 (56.36-81.55)	67.49 (52.23-92.35)	53.60 (47.74-78.08)	0.563	0.238
Fat (g/kg)	0.85 (0.71-1.48)	0.93 (0.86-1.39)	0.70 (0.27-1.84)	0.047	0.88 (0.83-1.25)	1.25 (0.95-1.61)	0.72 (0.59-0.92)	0.082	0.534
Fat (%)	31.61 (28.63-33.94)	31.51 (26.75-34.67)	31.56 (27.64-35.25)	0.402	34.14 (31.07-37.58)	34.15 (30.80-38.21)	34.10 (28.26-39.96)	0.402	0.110
SFA (g)	16.13 (15.20-24.12)	15.80 (13.09-27.30)	16.20 (13.04-24.33)	0.937	17.34 (16.22-27.78)	18.94 (13.71-31.46)	16.52 (13.17-28.25)	0.937	0.552
SFA (g/kg)	0.25 (0.10-0.84)	0.26 (0.24-0.48)	0.23 (0.13-0.31)	0.195	0.26 (0.24-0.42)	0.28 (0.25-0.53)	0.19 (0.14-0.37)	0.311	0.808
SFA (%)	9.76 (8.63-10.98)	8.75 (7.62-11.65)	10.02 (8.70-11.18)	0.910	9.79 (8.55-13.69)	9.68 (8.28-12.66)	10.11 (6.79-17.10)	0.910	0.875
Cholesterol (mg)	199.54 (157.81-444.73)	211.07 (90.32-640.31)	187.73 (159.88-289.54)	0.197	209.50 (184.92-454.39)	254.25 (174.40-555.99)	143.52 (56.16-448.54)	0.197	0.897
Cholesterol (mg/kg)	3.55 (2.37-7.18)	4.15 (1.84-11.16)	1.96 (1.95-3.98)	0.309	3.10 (2.85-7.01)	4.79 (3.27-9.47)	1.84 (0.41-6.01)	0.004	0.996
Fiber (g)	10.37 (10.80-15.72)	14.27 (11.73-20.32)	9.26 (8.53-11.48)	0.126	11.97 (11.82-19.89)	11.70 (10.15-18.86)	12.33 (9.35-24.38)	0.126	0.452
Fiber (g/kg)	0.15 (0.02-0.76)	0.24 (0.21-0.38)	0.11 (0.09-0.14)	0.006	0.19 (0.18-0.30)	0.23 (0.18-0.34)	0.14 (0.11-0.31)	0.726	0.534

Data were represented as median and 95% Confidence Interval. Abbreviations: SFA: Saturated Fatty Acid. Statistical comparisons were performed by Kruskal-Wallis 1-way ANOVA test (P value ≤ 0.05).

Table 3 Relations between the food intake, metabolic parameters and body composition of women with and without PCOS.

Nutrient	Metabolic parameters				Body composition		
	HOMA-IR	Fasting insulin	Fasting glucose	Glucose 120'	Body fat	Trunk fat	Android fat
Carbohydrate (g)							
PCOS	p = 0.231 r = -0.199	p = 0.335 r = -0.163	p = 0.300 r = -0.173	p = 0.905 r = -0.020	p = 0.357 r = -0.151	p = 0.355 r = -0.152	p = 0.298 r = -0.171
Controls	p = 0.771 r = -0.52	p = 0.832 r = -0.038	p = 0.377 r = -0.156	p = 0.119 r = 0.272	p = 0.992 r = 0.002	p = 0.896 r = -0.023	p = 0.779 r = -0.049
Protein (g)							
PCOS	p = 0.539 r = -0.103	p = 0.263 r = -0.189	p = 0.656 r = -0.075	p = 0.875 r = -0.026	p = 0.469 r = -0.120	p = 0.697 r = -0.064	p = 0.535 r = -0.102
Controls	p = 0.334 r = -0.171	p = 0.316 r = -0.177	p = 0.325 r = -0.174	p = 0.037 r = 0.359	p = 0.305 r = -0.181	p = 0.271 r = -0.191	p = 0.178 r = -0.233
Fat (g)							
PCOS	p = 0.328 r = -0.163	p = 0.111 r = -0.267	p = 0.972 r = 0.006	p = 0.520 r = 0.108	p = 0.611 r = -0.084	p = 0.597 r = -0.087	p = 0.664 r = -0.072
Controls	p = 0.491 r = -0.122	p = 0.558 r = -0.104	p = 0.276 r = -0.192	p = 0.005 r = 0.473	p = 0.988 r = -0.003	p = 0.965 r = -0.008	p = 0.808 r = -0.043
SFA (g)							
PCOS	p = 0.640 r = -0.078	p = 0.273 r = -0.185	p = 0.641 r = 0.078	p = 0.400 r = 0.141	p = 0.763 r = 0.050	p = 0.734 r = 0.056	p = 0.775 r = 0.047
Controls	p = 0.720 r = -0.064	p = 0.715 r = -0.065	p = 0.705 r = -0.067	p = 0.022 r = 0.393	p = 0.960 r = 0.009	p = 0.998 r = 0.000	p = 0.873 r = -0.028
Fiber (g)							
PCOS	p = 0.024 r = -0.365	p = 0.059 r = -0.313	p = 0.062 r = -0.306	p = 0.289 r = -0.176	p = 0.011 r = -0.401	p = 0.015 r = -0.388	p = 0.006 r = -0.431
Controls	p = 0.132 r = -0.263	p = 0.081 r = -0.303	p = 0.936 r = -0.014	p = 0.039 r = 0.356	p = 0.656 r = -0.079	p = 0.879 r = -0.027	p = 0.771 r = -0.051

Abbreviations: SFA: Saturated Fatty Acid; HOMA-IR: Homeostasis Model Assessment-estimated Insulin Resistance. Analysis by Spearman's correlation coefficient (P value ≤ 0.05).

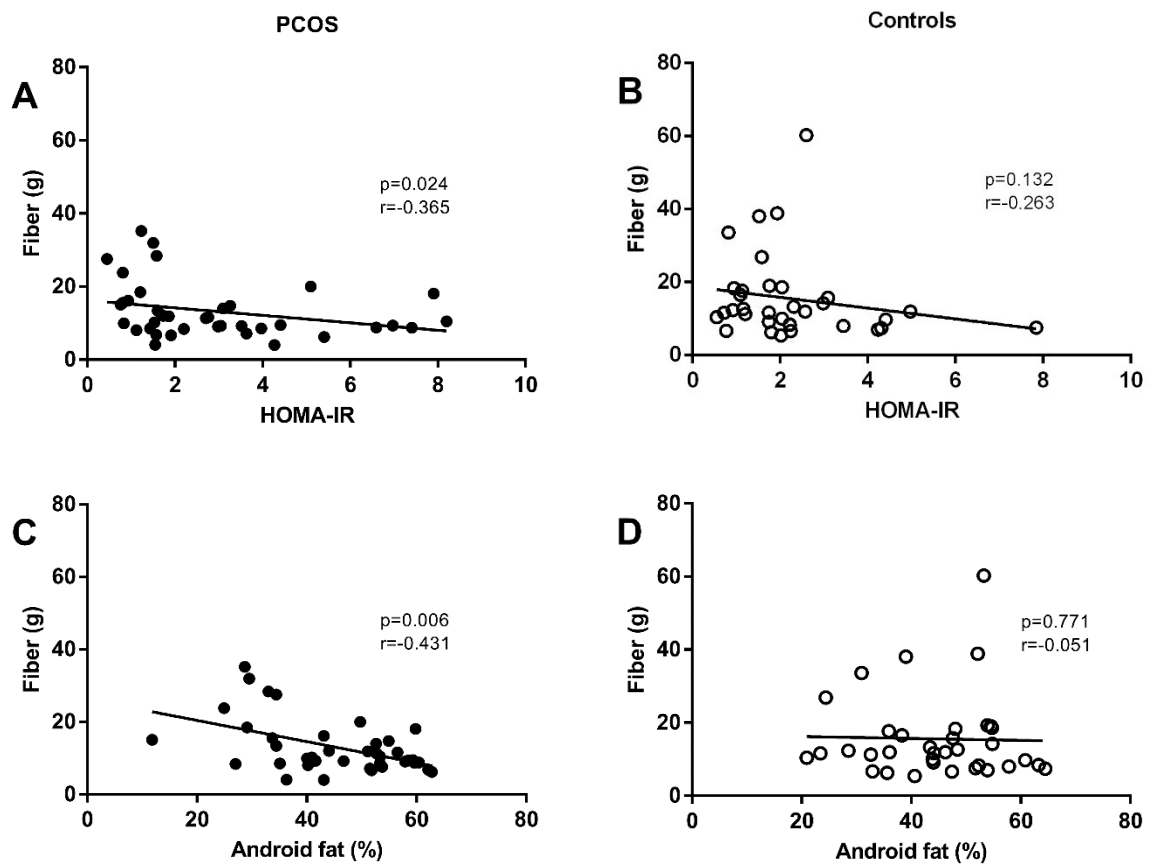


Fig. 1 Association between the fiber intake and HOMA-IR of women with PCOS (A) and controls (B), and association between the fiber intake and android fat of women with PCOS (C) and controls (D). Analysis by Spearman's correlation coefficient (P value ≤ 0.05).