ARTÍCULOS ORIGINALES

DIET COMPOSITION IS ASSOCIATED WITH OBESITY IN ACTIVE WOMEN

LA COMPOSICIÓN NUTRICIONAL DE LA DIETA SE ASOCIA CON OBESIDAD EN MUJERES ACTIVAS

Bruna Zavarize Reis (1), Dayanne da Costa (1), Diva Aliete dos Santos Vieira (1), Jamille Oliveira Costa (1), Pryscila Dryelle Sousa Teixeira (1), Oscar Felipe Falcão Raposo (2), Raquel Simões Mendes-Netto (1)

(1) Department of Nutrition, Federal University of Sergipe, São Cristóvão, Brazil.
(2) Department of Statistics, Federal University of Sergipe, São Cristóvão, Brazil.

ABSTRACT

This study evaluated the contribution of diet composition in physically active women to test the hypothesis that energy, lipids, carbohydrates and fiber are the nutrients that directly affect obesity in this population. We used a cross-sectional analysis of 165 adult women who practice at least 150 minutes of moderate physical activity per week. The outcome variables were body mass index (BMI) and waist circumference (WC). Individuals were classified into groups according to BMI as either obese or non-obese (BMI ≥ 30 kg/m² or < 30 kg/m², respectively), and by WC as either with risk or without risk (WC ≥ 88 cm or <88 cm, respectively). Dietary intake was assessed by a 24-hour dietary recall. A multiple means (ANOVA) was used to compare the mean consumption of the groups. In this study, 69.1% of women were overweight or obese. Obese women consumed significantly more energy and cholesterol and less carbohydrate (p <0.05) and tended to have a lower intake of fiber (p <0.10) than the non-obese women. Moreover, women with higher WC consume significantly more energy (p <0.05) and tend to have a lower consumption of carbohydrates and fiber (p <0.10) than women with minor WC. The results showed that, despite being physically active, the women studied had an average BMI indicative of obesity, showing that dietary patterns are highly correlated with this condition. We found that low consumption of carbohydrates and fiber and high consumption of energy and cholesterol contributed significantly to obesity among women.

Key words: cross-sectional study, diet composition, obesity, carbohydrates intake, cholesterol intake, physical activity.

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INTRODUCTION

In recent decades, the increasing prevalence of obesity worldwide has made this risk factor a major public health problem for mankind (1).

In recent decades, there has been a nutritional transition in Brazil. More traditional dietary patterns, such as diets based on cereals, roots and tubers, have been gradually replaced by a more Western diet, that is, consumption of foods rich in fats and sugars. This Western diet, combined with a decrease in physical activity, has lead to an increase in the number of cases of overweight and obesity (2-4).

It is widely recognized that being overweight or obese often results from an imbalance between energy intake and energy expenditure. While diet is a modifiable risk factor, the relationship between diet and obesity, and especially the role of macronutrients, remains controversial (5).

During the last decade, scientific research has focused on the macronutrient composition of the diet – the roles of fat, carbohydrates and protein in energy intake - and its relationship to body weight and weight loss. It has been suggested that the proportion of calories consumed as carbohydrates, proteins and fats may influence the etiology and control of overweight (6,7). Some authors have suggested that the proportion of energy from nutrients can contribute to changes in energy balance, leading to a higher accumulation of body fat by an imbalance between consumption and oxidation of the macronutrients ingested, even though the subjects showed a lower caloric intake (8).

Although there are individual differences regarding the mechanisms controlling energy balance, changes in body fat appear to be the result not only of the relationship between consumption and energy demand but also the relationship between consumption and oxidation of energy nutrients. In one study of adults, in which hyperphagia (excessive consumption of calories) was not the main trigger mechanism of obesity, a high proportion of lipids and low proportion of carbohydrates in the diet were effective contributors to the increase in the amount of body fat (9).

There are innumerable disadvantages mentioned for a diet rich in lipids. Dietary lipids hinder the treatment and prevention of excess body fat, have the greatest energy density and storage capacity, have greater palatability, and have less power to satiate, due to their effect on leptin (8). Low-fat and low glycemic index diets produce low glucose response and may help control body weight, because they promote satiety, minimize postprandial secretion of insulin and maintain insulin sensitivity (9).

Despite this evidence, many studies have failed to find any relationship between diet composition and risk of overweight/obesity. More recently, some authors have suggested that, in obesity, total energy intake is more important than quality (the balance of nutrients) (10).

Thus, this study evaluated the contribution of diet composition in physically active women to test the hypothesis that high consumption of fat and low carbohydrate intake are important factors in the etiology of obesity in this population. This study is relevant to human nutrition because there is little evidence to demonstrate the true influence of diet composition on body weight control.

METHODS AND MATERIALS

Subjects and design

This cross-sectional study was conducted with 165 adult users of eleven centers of the Academia da Cidade Program (Sergipe, Brazil), who performed at least 150 minutes of moderate physical activity per week and were between 18 and 59 years old. This is a public program to encourage regular physical activity in public places, consisting of collective exercises and walks of low intensity. The men were not included in the study because of their low participation in the program.

Individuals with specific dietary guidelines for disease treatment and pregnant or lactating women, were excluded. Data were collected between February and September 2009 in all eleven centers, and each center was analyzed for about a month.

To select, evaluate and monitor the individuals who comprised the study population, the team that conducted this research followed all the rules established in Resolution 196/1996 on research involving humans. The Federal University of Sergipe Institutional Review Board approved the study protocol and all participants provided written informed consent.

Dietary assessment

To evaluate the habitual consumption of foods and nutrients two dietary recall surveys were administered, with an interval of at least 1 week and a maximum of 15 days between the first and second recall. This instrument collects information about all foods and beverages that respondents consumed during the 24 hours preceding the interview day. It is a validated instrument, often used in epidemiological studies that assess the current consumption of individuals, is generally well accepted by respondents, has a low cost and it can be implemented quickly (11). The interviews were conducted by trained interviewers.

From the data obtained, calculations to quantify the amount of energy and nutrients were carried out with the help of the software Virtual Nutri Plus, version 2.0 Plus (2008, School of Public Health, University of São Paulo) and complemented with Table Composition of Foods (12). The assessment of dietary intake was based on the Dietary Reference Intakes – DRI (13).

We analyzed the average individual intake of carbohydrate, protein, fat, fiber and cholesterol. Because measurement bias due to consumption differences can produce inconsistent results, all nutrients were corrected for energy intake, as suggested by Slater et al (14). This method uses the analysis of at least two independent measurements of food consumption on non-consecutive days and allows us to remove the day-to-day variation in consumption due to intrapersonal reasons with lower variance than the distribution estimated using only one day of dietary intake. This adjustment was made by means of residual consumption, where the gross consumption of the nutrient effect was removed from power through the residuals of a simple linear regression model with total energy intake as the independent variable and gross consumption of the nutrient as the dependent variable (14).

The final percentage result of consumption it is not a total of 100% because this adjustment change the amount of macronutrients intake, thus the sum of them it is variable.

Considering that the sub-report is widely distributed in food surveys, we also assessed underreporting of energy consumption using methods proposed by Garriguet (15). An energy expenditure value was predicted for each respondent, based on age, weight, sex, height, physical activity and body mass index (BMI) category. The ratio of reported energy intake to predicted energy expenditure was then calculated. A range in the form of [exp(-SD); exp(SD)] was assigned to this ratio, where SD represents a standard deviation. Taking into account intraindividual variation of energy intake, the error in predicted requirements and day-to-day variation, and the measurement error for total energy expenditure, SD was estimated at 35%, yielding a range of 0.70 to 1.42. Based on the assumption of a weight-stable population, respondents whose ratio fell within this range were considered "plausible" respondents, that is, their reported energy intake was 70% to 142% of their predicted energy expenditure (15). In calculating these needs, we used the equations proposed by the IOM/DRI (13). The physical activity level was standardized as less active (1.12) for all individuals. This level is defined as 30 to 60 minutes of daily moderate activity.

Anthropometric measures

Anthropometric measurements (weight, height and waist circumference) were performed according to techniques recommended by Lohman (16). For measurement of height, a portable stadiometer (ALTUREXATA, range 35 to 213 bilateral cm, resolution 0.1 cm) was used. Weight was measured using a digital scale (Líder, model P-150M, with a capacity of 150 kg, graduation of 100g). Waist circumference was measured using a tape of synthetic material does not extend, graduated in millimeters, with a total length of 200 cm (Sanny). The measurement was performed twice and the average value was used in the analysis.

The nutritional status of participants was assessed by the Body Mass Index - BMI (kg/m^2) and analyzed according to the World Health Organization (WHO) classifications (17).

Waist circumference (WC) was used as an indicator of visceral fat and classified according to the perimeters established by WHO (18).

Statistical analyses

We used descriptive statistics of absolute and relative frequency, mean, standard deviation and confidence interval for the presentation of anthropometric data, age, energy requirements and food consumption.

The study subjects were divided into two groups according to nutritional status and risk classification of excess visceral fat. To compare the nutrient intake, individuals in this study were classified into groups according to BMI as either obese or non-obese (BMI ≥ 30 kg/m^2 or < 30 kg/m^2, respectively), and by WC as either "Risk +" or "Risk -" (WC ≥ 88 cm or <88 cm, respectively).

For comparison of the mean intake of the groups, an analysis of multiple means (ANOVA), was used. All statistical analysis adopted a significance level of 5% ($p = 0.05$). Data entry was done in Excel® and then exported and analyzed with the aid of the Statistical Package for Social Scienes® of Windows (version 17.0, 2007, SPSS Inc, Chicago, IL). Throughout the text, data are presented as mean ± standard deviation (SD).

RESULTS

The total study population consisted of 165 participants. However, after excluding individuals who had reported the daily energy intake below 70% (n=66) or above 142% (n=2) of their EER, using the methodology proposed by Garriguet (15), there was a reduction of greater than 40% in the number of participants. Therefore, the analysis refers to only the 97 women with plausible reports of energy intake.

The anthropometric data is presented in table 1 along with the subjects' average age and EER. On average, the participants were overweight (BMI = 26.34 ± 3.95 kg/m^2). Of the 97 women, 16.5% were obese (BMI ≥ 30 kg/m^2) and 30.9% were eutrophic (BMI < 25 kg/m^2). The average waist circumference (85.59 ± 9.45 cm) was classified as showing an increased risk for chronic diseases.

Table 2 presents a general profile of the average nutrient intake of the plausible recalls evaluated (n = 97) and their recommendations. Tables 3 and 4 correlate the intake of macronutrients, cholesterol and dietary fiber with BMI and waist circumference, respectively. It may be noted that, with regard to BMI (Table 3), the obese women consume significantly more energy and cholesterol and less carbohydrate ($p < 0.05$) than the non-obese women. With respect to fiber, there was an inverse trend between BMI and daily fiber consumption, corrected for energy intake ($p = 0.07$).

In table 4, note that individuals with larger waist circumferences consume significantly more energy ($p < 0.05$) and tended to have lower consumption of carbohydrates ($p = 0.06$) and fiber ($p = 0.07$).

DISCUSSION

In recent years, there has been a large increase in the prevalence of obesity throughout Brazil (19). The causes of this worldwide rise in obesity have not been sufficiently clarified. According to a study by the WHO, BMI values between 25 and 30 are responsible for the greatest impact of overweight on certain co-morbidities associated with obesity (17).

Table 1 shows that the average BMI of participants are in the overweight category (26.34 ± 3.95 kg/m²) and their waist circumferences are categorized as having an increased risk of chronic diseases (85.59 ± 9.45 cm). This highlights the importance of intervening in the population's eating habits, because physical activity itself does not have the same efficacy alone as it does when it is undertaken in association with changes in eating habits (20).

The sample used for these tests was reduced by greater than 40% after excluding individuals who under-or over-report their daily caloric intake. Obesity is a major indicator of underreporting (21). In obese individuals, the discrepancies between reported food intake and measured energy expenditure (with the doubly-labeled water method) range from 20 to 50% (22,23). However, it is important to note that under-reporting is not unique to obesity, but also occurs in normal-weight individuals (24). Moreover, women more frequently under-report

TABLE 1

Estimated energy requirement, and anthropometric measurements of adult women participating in the Academia da Cidade Program (Sergipe, Brazil).

	Mean	SD*	Minimum	Maximum
Age (years)	50.65	8.2	22.00	59.00
Weight (kg)	62.48	9.68	45.70	89.70
Height (m)	1.54	0.06	1.36	1.69
BMI (kg/m²)	26.34	3.95	19.07	37.34
Waist circumference (cm)	85.59	9.45	67.40	114.00
EER (kcal/d)	1,964.56	167.62	1,662.56	2,463.76

* Standard deviation

TABLE 2

Energy consumption, macronutrients, fiber, and cholesterol in adult women participating in the Academia da Cidade Program (Sergipe, Brazil).

	Mean	SD*	Minimum	Maximum	Recommendation‡
Energy (kcal/d)	1,806.56	376.25	1,250.88	2,764.27	1,964.56¦
Carbohydrate (g/d)	248.75	42.78	132.28	340.48	
% energy	(54.62%)	(10.60%)	(25.38%)	(76.61%)	45 – 65%
Total fat (g/d)	53.90	13.27	24.06	97.14	
% energy	(26.47%)	(8.06%)	(8.33%)	(52.34%)	20 – 35%
Protein (g/d)	85.90	19.39	46.63	175.35	
% energy	(18.91%)	(5.45%)	(7.95%)	(44.25%)	10 – 35%
Fiber (g/d)	18.93	10.17	8.66	86.72	21 – 25
Cholesterol (mg/d)	219.74	93.25	66.67	653.02	< 200

* Standard deviation.
‡ Recommendation calculated based on groups of women 19-30 years, 31-50 years and 51-70 years according to the DRI (2005).
¦ Calculation made from the average of Estimated Energy Requirement for each participant.

their intake because of higher cultural and social pressures to maintain healthy eating habits and slim body pattern (25). Hence, it is important to adopt a method that excludes these food reports so that the study can produce consistent results.

When the data were processed (not shown), considering all subjects (n = 165) there were no significant differences between obese and non-obese. Only after excluding the 68 subjects who under-or over-reported their consumption was it possible to obtain consistent results. The average under-reporting in this study was 41 ± 19.9% less than EER, which was much higher than in an earlier study of obese women, whose average underreporting was 18.0 ± 29.1% (26).

In this study we used two 24-hour recalls to estimate regular consumption, in view of the intra-and interpersonal differences common with this method.

We must consider the difficulties in accurately and

TABLE 3

Consumption of energy, macronutrients, fiber and cholesterol according to the cutoffs of BMI < 30 kg/m^2 (non-obese) and BMI ≥ 30 kg/m^2 (obesity), in adult women participating in the Academia da Cidade Program (Sergipe, Brazil).

	NON-OBESE (n=81) BMI < 30 kg/m^2 Mean ± SD*	OBESE (n= 16) BMI ≥ 30 kg/m^2 Mean ± SD*	P value‡
Energy (kcal/d)	1,767.31 ± 367.83	2,005.26 ± 366.04	< .05
Carbohydrate (% energy)	59.05 ± 13.32	48.23 ± 14.87	< .05
Protein (% energy)	19.95 ± 5.61	18.78 ± 5.18	NS
Total fat (% energy)	28.29 ± 8.65	26.43 ± 7.72	NS
Cholesterol (mg/d)	211.02 ± 83.43	263.88 ± 126.65	< .05
Fiber (g/100kcal)	1.14 ± 0.65	0.84 ± 0.25	NS

* Standard deviation
‡ P value obtained from an analysis of multiple means (ANOVA).

TABLE 4

Consumption of energy, macronutrients, fiber and cholesterol in conformity to the cutoff points for waist circumference (WC) according to the risk* (“Risk –” < 88 cm and “Risk +” ≥ 88 cm), in adult women participating in the Academia da Cidade Program (Sergipe, Brazil).

	“RISK –” < 88 cm (n=62) Mean ± SD‡	“RISK +” ≥ 88 cm (n=35) Mean ± SD‡	P value
Energy (kcal/d)	1,743.59 ± 368.07	1,918.09 ± 369.60	< .05
Carbohydrate (% energy)	59.23 ± 14.12	53.77 ± 13.54	NS
Protein (% energy)	20.42 ± 5.55	18.58 ± 5.37	NS
Total fat (% energy)	29.02 ± 8.11	26.14 ± 8.96	NS
Cholesterol (mg/d)	214.99 ± 84.95	228.14 ± 107.20	NS
Fiber (g/100kcal)	1.17 ± 0.72	0.94 ± 0.28	NS

* Relative risk for type 2 diabetes, hypertension and coronary heart disease.
‡ Standard deviation.
¦ P value obtained from an analysis of multiple means (ANOVA).

precisely estimating diets, because of their variable nature (27). The daily variability of the diet depends on the actual variation in foods consumed by individuals because of the diversity, heterogeneity and fluctuations in day-to-day in food items. One should also note that individuals have different intrinsic characteristics, such as preferences, which lead them to select different foods (14). The influence of factors such as seasonality, day of week, sequence of application, or different interviewers explains a small proportion of the variability of consumption (28).

The application of statistical methods enables us to remove the variability of day-to-day variation in consumption due to intrapersonal reasons. In this case, the intake distribution will reflect only the variation that exists among individuals in the group. To apply statistical methods for adjusting a diet, it is necessary to have at least two independent measurements from at least a representative sample of the individuals on non-consecutive days (14). Only through repeated observations is it possible to estimate the variability of daily nutrient intake (29).

The nutrients listed in table 2 have been corrected for variations in intra-and inter- personal reporting and energy (14). The average daily caloric intake (1806.56 ± 376.25 kcal) is lower than recommended by the EER (1964.56 kcal/day) recommended by the IOM/DRI (13). Macronutrient intake (protein, carbohydrates and lipids) was within the ranges of the institute's recommendations, although fiber intake was below and cholesterol intake was above recommended levels.

Tables 3 and 4 show the average intake of nutrients according to the classifications of BMI and WC, respectively. The analysis of table 3 allows us to assert that obese women consume significantly more energy, cholesterol and fewer carbohydrates ($p < 0.05$) than non-obese women. They also tend to have a lower fiber intake ($p < 0.07$). This indicates that the carbohydrates consumed, in addition to being consumed in smaller quantities, are mostly simple carbohydrates, because the consumption of fiber from them is low (0.84 ± 0.25 g/100kcal). Similar results were found in a study of Canadian adults, in which obese women consumed more calories than non-obese ($p < 0.05$) and less fiber ($p < 0.05$) (10).

Not surprisingly, obese women ingested significantly more calories than non-obese women (table 3), because fat deposition is associated with the principle of energy balance; that is, if a person consumes more energy than which uses, there is an increase in weight (30). The health risk is the estimate that for every 5% increase in weight over a person's weight at 20 years old corresponds to a 200% increase in the risk of developing metabolic syndrome in middle age (31).

The group "Risk +" also had a higher total energy intake ($p < 0.05$) compared with group "Risk –" (table 4), and tended to have a lower intake of carbohydrates ($p = 0.06$) and fiber ($p = 0.07$). WC is highly correlated with the amount of visceral fat, which is an independent predictor for an increased risk for diabetes, hypertension, dyslipidemia and ischemic heart disease (32).

Dietary fiber has been studied as a preventive factor in the development of obesity (10); it inhibits digestion of other carbohydrates, and is fermented in the colon, resulting in the release of short chain fatty acids into the circulation. These factors are responsible for better glucose control (33). Furthermore, it has been suggested that dietary fiber slows gastric emptying, contributing to greater sense of satiety, and that fiber-rich foods tend to have low calories (13).

Several studies have described beneficial effects of dietary fiber on glycemic control and blood lipids [34-39]. More recently, Babio et al (40) reviewed the effects of fiber on blood lipids in humans and found that consumption of viscous fibers reduced the serum levels of LDL-cholesterol (LDL-C) and postprandial glucose, and induced satiety in the short term.

Besides the lower fiber intake, obese women also showed a greater consumption of cholesterol compared to non-obese women (table 3). Similar results were found by Trecco et al (41), whose study assessed the food intake of obese patients of the Hospital of the Faculty of Medicine, University of São Paulo. It was observed that in addition to high cholesterol intake, obese patients also had a low intake of fiber.

The risk of this dietary pattern is the fact that low intake of dietary fiber and high cholesterol intake raises plasma cholesterol levels. A review of cholesterol and atherosclerosis studies found that a reduction of 100 mg/day in cholesterol intake resulted in mean reduction from 2.2 to 2.5 mg/dL in plasma levels of total cholesterol, with a change of 1.9 mg/dL in LDL-C and 0.4 mg/dL in HDL-cholesterol (HDL-C) (42).

Although lipid intake in this study was not statistically different between the two groups (table 3), previous studies have found that saturated fat is the main cause of rising serum cholesterol (43). Saturated fatty acids are associated with increased total cholesterol and LDL-C, as well as the elevation of triglycerides (44). Trans fats also cause elevation of cholesterol, with the added disadvantage of reducing HDL-C (45). Dietary cholesterol is directly related to higher LDL-C (46). However, this is a minor effect compared with that of saturated fats (47).

We found that consumption of carbohydrates was lower among obese women ($p < 0.05$) (table 3), similar to the results of Merchant et al. (48) in a study of Canadian adults. They found that increased consumption of carbohydrates in the diet (47% to 64% of total energy intake) was associated with lower rates of overweight and obesity, lower caloric intake and a higher intake of fiber. The authors also reported that diets rich in complex carbohydrates reduce the risk of developing overweight and obesity by 40% ($p = 0.01$).

Studies have shown that diets rich in carbohydrates affect the appetite, or in the post-prandial phase, carbohydrates promote their own oxidation, stimulating insulin secretion and cellular glucose uptake. If the diet contains little carbohydrate, people may experience increased hunger. In the late postprandial phase, when glycogen stores decrease, glucose oxidation decreases and hunger sensation begins to increase. The mechanisms that slow the process of glycogen depletion increase the period of satiety (49,50).

Moreover, there is evidence that low carbohydrate intake leads to increased consumption of lipids (51), whose consequence is a greater deposition of body fat by promoting adipogenesis (52).

Dietary fat may weaken the regulation of energy consumed, that is, foods rich in fat reduce plasma leptin levels for 24 hours, which can trigger the release of neuropeptide Y, which has the role of increasing food intake (8). Consequently, the consumption of foods high in fat contributes directly to positive energy balance, hunger and increases the amount of energy consumed, leading to weight gain. There is a higher incidence of obesity among regular consumers of foods rich in lipids than among consumers of foods with low fat content (53,54).

There is no consensus on the best dietary pattern for the maintenance of ideal weight. Clinical studies have shown that low carbohydrate diets are more effective in reducing body weight in the short term (six months) than high carbohydrate diets. However, after one year there were no significant differences between the groups (55).

Noakes et al (56) compared the efficiency of a low carbohydrate diet (46% of energy from carbohydrates) with the adoption of high carbohydrate diet (64% of energy from carbohydrates) on weight loss in women with overweight and obesity, and noted that in the short term (12 weeks), there were no significant differences in weight loss between groups (reduction of 7.6 ± 0.4 kg versus 6.9 ± 0.5 kg respectively).

A study of overweight and obese adults also showed that after two years of following a diet rich in carbohydrates (65% of energy from carbohydrates) and consuming a minimum of 20 grams of fiber per day, participants significantly lower ($p = 0.01$) LDL-C than those with a low carbohydrate diet (35% of energy from carbohydrates) (57).

The recommendations for the intake of carbohydrates refer to those high in fiber (complex carbohydrates), not the sugars (simple carbohydrates), because they contribute to the increased energy density of the diet, promoting a positive energy balance (18) and have a higher glycemic index, changing the glucose-insulin responses (58).

We conclude that the women studied, despite being physically active regularly, had an average BMI of overweight, calling attention to the fact that dietary patterns are highly correlated with this factor. In this study, we found that low consumption of carbohydrates and high energy and cholesterol intake contribute significantly to obesity among the women studied.

The main limitation of this study is not being able to use more accurate methodology for estimating the food intake, such as a weighed food record.

RESUMEN

El objetivo de este estudio fue avaluar la contribución de la composición de la dieta en el sobrepeso de mujeres que practican actividad física, basado en el supuesto de que el alto consumo de energía y lípidos y el bajo consumo de carbohidratos y fibras son factores preponderantes en la etiología de la obesidad de esta población. Se utilizó un análisis transversal en 165 mujeres adultas que practicaban, por lo menos, 150 minutos de actividad física moderada por semana. Las variables de resultado fueron el índice de masa corporal (IMC) y la circunferencia de la cintura (CC). Las personas se clasificaron en grupos según el IMC – obesos (IMC $\geq$ 30 kg/m^2) y no obesos (IMC < 30 kg/m^2) – y de acuerdo con CC – con riesgo $\geq$ 88 cm y sin riesgo <88 cm. La ingestión dietética se evaluó con una encuesta de recordatorio de 24 horas. Para hacer la comparación de las medias de consumo de los grupos se utilizó el análisis de varianza (ANOVA). Se observó que 69,1% de las mujeres presentaban sobrepeso/obesidad. Las mujeres obesas consumían significativamente más energía y colesterol y menos carbohidratos ($p < 0{,}05$) y menos consumo de fibras ($p < 0{,}10$), lo que no sucede en las mujeres no obesas. Además, las mujeres con mayor CC consumían significativamente más energía ($p < 0{,}05$) y presentaron una tendencia para menor consumo de carbohidratos y fibras ($p < 0{,}10$), lo que no sucede en las mujeres con menor CC. Los resultados mostraron que, aunque estas mujeres eran fisicamente activas, tenían un IMC medio de sobrepeso, lo que indica que los hábitos alimentarios están altamente correlacionadas con este factor. Se sugiere que el bajo consumo de carbohidratos y fibras y el alto consumo de energía y colesterol han contribuido expresivamente para la obesidad entre las mujeres.

Palabras clave: estudo transversal, composición de la dieta, obesidad, consumo de carbohidrato, consumo de colesterol, actividad física.

Dirigir la correspondência a:
Profesora
Raquel Simoes Mendes-Netto
Departamento de Nutrição
Centro de Ciências Biológicas e da Saúde
Universidade Federal de Sergipe
Av. Marechal Rondon, s/n Jardim Rosa Elze
CEP 49100-000
Cidade Universitária Professor
"José Aloísio de Campos"
Universidade Federal de Sergipe, São Cristóvão-SE.
Tel/Fax: 79 21056662
E-mail: raquel@ufs.br

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