Original Article

Investigating and comparing energy and macronutrient intake in female aerobic athletes in two different socio-economic regions

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ABSTRACT

Background: The purpose of this study was to assess nutritional intakes of female aerobic athletes in two different socio-economic classes in city of Isfahan. **Materials and Methods:** The participants of this analytical study were 99 female aerobic athletes aged between 15 and 50 years old who were randomly sampled (50 females in low economic region and 49 females in high economic region). The demographic details were collected by a questionnaire, and anthropometric indexes including height, weight, and waste circumference were measured using a tape measure and a scale. They filled out the 24-hour food recall questionnaire for two consecutive days in order to obtain their nutritional information. To analyze the data, Nutritionist 4 and $SPSS_{18}$ software were used. **Results:** The means of energy intake in high and low regions were 1479.19 ± 561.86 and 1300.68 ± 498.354 kcal, respectively. There was no significant difference in terms of energy intake between these two groups ($P = 0.98$). The means of protein intake in low and high socio-economic classes were 17.41 ± 5.85 and 54.48 ± 6.62, respectively, and no significant differences were observed between these two regions ($P = 0/606$). The means of carbohydrate intake were 61.85 ± 9.76 and 54.48 ± 6.62 in the low and high socio-economic classes with a significant difference between them ($P < 0.001$). The mean of carbohydrate intake in the low socio-economic class was considerably higher than that in the high socio-economic class. The means of fat intake were 23.88 ± 8.24% and 30.07 ± 6.68% in the low and high socio-economic classes, respectively, and the means of fat intake in the high socio-economic region was significantly higher than that in the low socio-economic region ($P < 0/001$). **Conclusion:** The findings of this study indicated that the intakes of fat and carbohydrate were significantly different in the two different socio-economic regions in city of Isfahan. This difference could be attributed to different food patterns in these two regions.

Key words: Athlete, macronutrients, socio-economic region

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INTRODUCTION

Nutrition is one of the crucial factors for the health of individuals. In addition to genetic factors and sports activity, nutritional situation determines an athlete's performance in sports.[1]

Diet significantly affects athletes' performance. Getting enough nutrients is essential for daily exercises and proper performance during training and competitions.

All athletes in all age groups need to receive enough energy from foods in order to compensate for the consumed energy,

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maintain body weight and health and to increase the effects of sports. Failure in receiving sufficient energy may cause muscle atrophy and bone mass decrease and increase risk of fatigue, injury, disease, and menstrual disorders in young women.

Carbohydrate, protein, and fat supply energy for athletes. Carbohydrates provide the energy required for body cells, particularly the brain cells, which are the only carbohydrate-dependent part of body. Carbohydrates are also essential for maintaining the level of blood glucose during exercising, restoring muscle glycogen at rest and consuming it during exercise. Protein provides essential amino acids to compensate for the muscle loss during exercising, increase in lean tissue and also increase in the consumption of protein as a fuel during exercising. Fat is the supplier of energy, fat-soluble vitamins, and essential fatty acids for athletes' diet.[2]

In a research on the athlete students in Zahedan University of Medical Sciences, it was observed that 43.3% and 6.7% of students had deficiency in receiving energy and protein per day, respectively.[3]

Also, in a study on 10 female athletes, Azemati and Tavakkoli showed that total energy intake was composed of 36.3% carbohydrates, 14.67% proteins, and 49.03% fat, which indicated the imbalanced pattern of consuming macronutrients.[4] A study on women swimmers reported the average protein, fat, and carbohydrate intakes as 15%, 32%, and 53%, respectively, all of which were stated according to RAD.[5]

The findings of a study by Lun *et al*. on the women with high sports activities revealed that the average intakes of protein, fat, and carbohydrate were 19%, 28%, and 53% of the total daily energy. In this study, some nutritional recommendations on protein intake were considered essential.[6]

In a study conducted on 72 professional women athletes, the average intake of macronutrients, fat, and carbohydrate was 19%, 31%, and 46% out of total energy intake per day, respectively.[7]

The necessity of the present study becomes evident considering the results of different studies and lack of investigation on the nutritional situation of female aerobic athletes in Isfahan. This article considered the situation of macronutrient intake in female aerobic athletes in city of Isfahan in two different economic regions.

MATERIALS AND METHODS

The studied population included athlete women who went to aerobic gyms in two different socio-economic regions in the city of Isfahan.

Inclusion criteria

The inclusion criteria were female gender, having at least 3 one-hour aerobic exercise sessions per week, and being in the age group of 15-50 years old. The exclusion criteria included suffering from diabetes, pulmonary, or cardio-vascular diseases and dissatisfaction with the participation in the study.

Sample size and sampling method

In this study, city of Isfahan was divided into two socio-economic regions. The sampling method was simple random sampling, and the sample population was 99 people (50 from low economic region and 49 from high economic region). This study was performed in Isfahan in 2009.

Data collection methods and tools

Demographic information was obtained by a general knowledge questionnaire consisting of the variables of age, educational level, marital status, occupation, exercise duration per day, smoking status, pregnancy and breastfeeding status, history of specific diseases, drug history, taking food supplements, following a special diet, and having food allergies. Food nutrition information was obtained by the 24-hour food recall questionnaire, which was filled out on two consecutive days. To obtain anthropometric indexes including height, weight, waist circumference, wrist size, and hip circumference, a tape measure and a spring scale were used.

Work procedure

This cross-sectional study was conducted on 99 women who attended aerobic gyms in two socio-economic regions in the city of Isfahan in 2009. The samples were selected through simple sampling method and enrolled in the study after the approval of participants.

After obtaining required permits and coordinating with the managers and coaches of aerobics clubs in the two regions, the researchers went to the clubs, informed the participants, and gathered demographic information including age, educational level, marital status, occupation, exercise duration per day, smoking status, pregnancy and breastfeeding status, having specific disease, drug history, taking food supplements, following special diets, and food allergies by the questionnaire. Food nutrition information was obtained by the 24-hour food recall questionnaire filled out on two consecutive days. To measure anthropometric indices including height, weight, waist circumference, wrist sizes, and hip circumference, a tape measure and a spring scale were used. Standard reference tables were used to convert domestic values to gram, and food items were entered into the Nutritionist 4 nutritional software after encoding.

Data analysis

To compare the average intake of different nutrients in the samples with their recommended amounts (RDA), a t-test was used. An independent t-test was used for comparing the average intake of different nutrients in the two groups and Pearson Correlation was applied for checking the relationship between different variables. All the data were described as mean ± standard deviation, and the significance level was $P < 0.05$.

Ethical considerations

Before going through the study, the researcher talked about the project, its aims, and processes with all the participants. They were asked to participate in this study if they liked. Moreover, this project was approved in Research Council meeting of Food Security and Nutrition Research Center, Isfahan University of Medical Sciences, and the Committee of Ethics also approved it.

RESULTS

The means of protein intake in female athletes in low and high economic regions were 17.41 ± 5.85% and 17.94 ± 4.12% out of total energy intake per day, respectively. There was no significant difference between the protein intake of female athletes in low and high economic regions [Figures 1 and 4] ($P = 0.606$).

The means of carbohydrate intake in female athletes of low and high economic regions were 61.85 ± 9.76% and 54.48 + 6.62% out of total energy intake per day, respectively. Carbohydrate intake in female athletes in the low economic region was significantly higher than that in those of high economic region [Figures 3 and 5] ($P \leq 0.001$).

The means of intake fat in female athletes in high and low economic regions were 30.07 ± 6.68% and 23.88 ± 8.24% out of total energy intake per day, respectively. Fat intake in the female athletes in the high economic region was significantly higher than that in those of low economic region [Figures 2 and 6] ($P < 0.001$).

The means of energy intake in female athletes in high and low economic regions were 1479 ± 561.8 and 1300.68 ± 498.354 kcal, respectively, and there was no significant difference between the two groups ($P = 0.098$).

The means of protein intake in female athletes in low and high economic regions were 17.41 ± 5.85% and 17.94 ± 4.12% out of total energy intake per day, respectively, while the recommended protein intake was between 10% and 15%. This indicated that in both economic regions, women had more protein intake than the maximum recommended amount.

The means of carbohydrate intake in female athletes in low and high economic regions were 61.85 ± 9.76% and 54.48 ± 6.62% out of total daily energy, respectively. The recommended amount of carbohydrate intake was between 45-65%, indicating that, on an average, carbohydrate intake in both economic regions was within the recommended range.

The means of fat intake in female athletes in high and low economic regions were 30.07 ± 6.68% and 23.88 ± 8.24% out of total daily energy, respectively. The recommended amount of fat intake was between 20% and 35%, so, on an average, fat intake was in the recommended range, as well.

The means of energy intake in female athletes in high and low economic regions were 1479 ± 561.86 and 1300.68 ± 498.354 kcal, respectively, which was less than the standard amount (2100 kcal) in both areas ($P < 0.001$).

The mean of investigated anthropometric indexes (BMI, waist circumference, waist circumference: Hip circumference) in low economic region was significantly higher than that in high economic region; the amount of *P* is given in Table 1.

DISCUSSION

The participants in this study were female aerobic athletes who went to aerobic exercise classes 3 days a week and an hour each time. These athletes were studied in two low and high economic regions.

The means of energy intake in female athletes in high and low economic regions were calculated as 1479 ± 561.86 kcal and 1300.68 ± 498.354 kcal, respectively, which was significantly less than the recommended amount (2100 kcal/d) in both regions. This finding was in agreement with those of other studies, which showed that energy intake in female athletes was insufficient.

A study by Deuster *et al.* on female track-and-field athletes revealed that the energy intake of 75% of the participants was less than the energy required for maintaining balance in this group of athletes (2600 kcal/d).[8] Based on other studies by Leblance *et al.* and Tremblay *et al.*,[9,10] and Deuster *et al.*, the reason for less energy intake was the limitation in energy intake, which was imposed by women athletes themselves. However, this voluntary restriction on energy intake was only observed in some cases.

In another study by Vallieres *et al.* on women swimmers, the mean daily energy intake was calculated as 2472 ± 717 kcal, which seemed to be sufficient[11] and was more than the amount of energy (1200-1400) reported by other researchers in other sports fields for women.[12-15]

Another study performed on American women soccer players demonstrated that these athletes had the average energy intake of 2015 kcal/d, which was more than the energy intake in other similar sports like basketball (1513 ± 406); however, the energy intake of this group was less than the calculated amount of Harris Bandick.[16]

Table 1: Comparing the means of anthropometric indexes in two socio-economic regions of city of Isfahan

	High economic region	Low economic region	*P* value
BMI	22.91 ± 3.38	24.90 ± 4.10	0.01
Waist circumference	75.04 ± 9.25	84.92 ± 11.25	< 0.001
Waist circumference / hip circumference	0.76 ± 0.06	0.83 ± 0.09	< 0.001

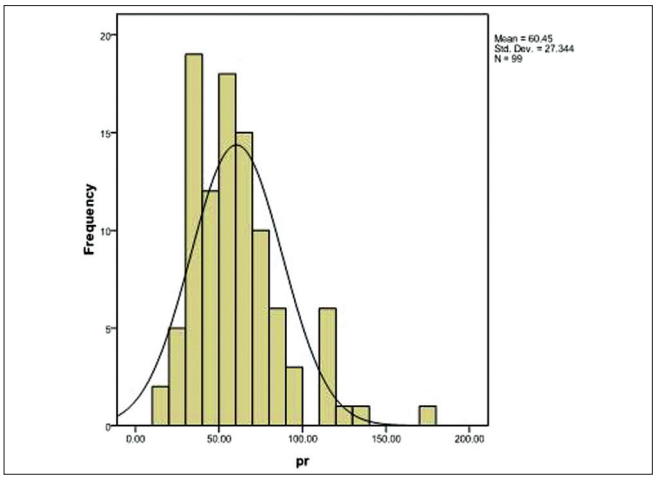

Figure 1: Distribution of protein intake (in gram)

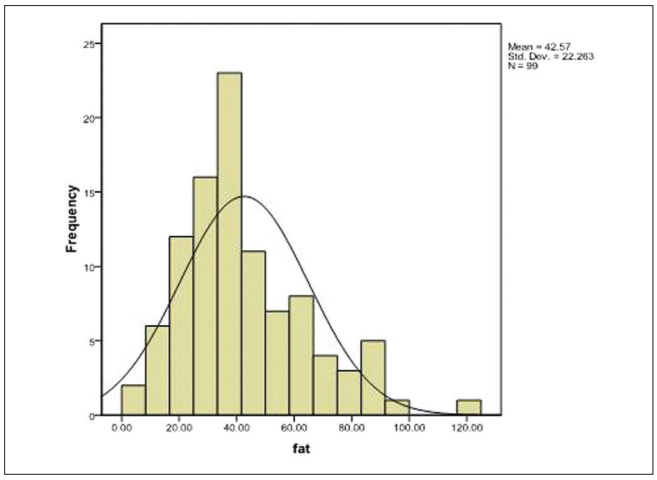

Figure 2: Distribution of fat intake (in gram)

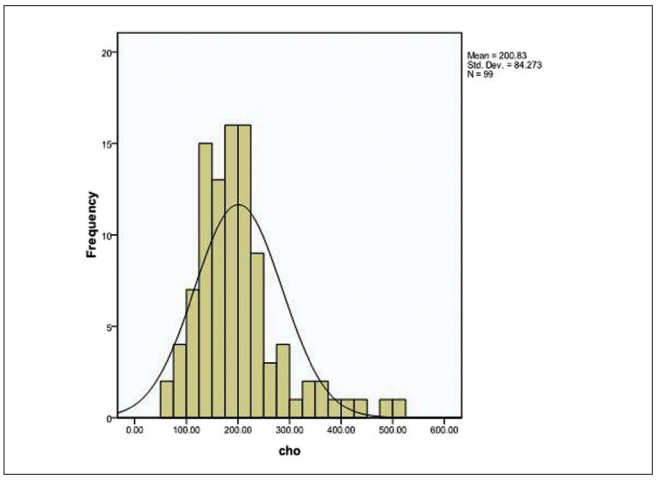

Figure 3: Distribution of carbohydrate intake (in gram)

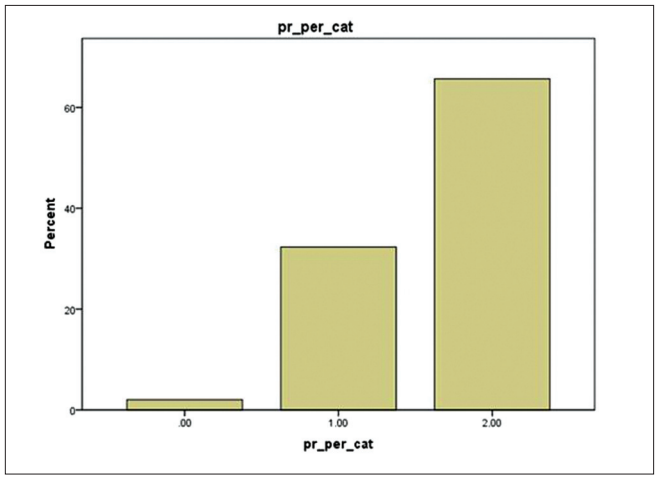

Figure 4: Amount of protein intake, 0) Less than 10%, 1) 10- 15%, 2) More than 15%

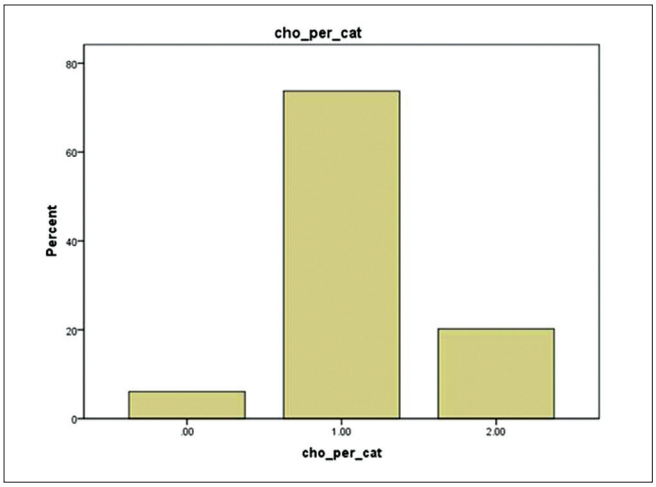

Figure 5: Amount of carbohydrate intake, 0) Less than 45%, 1) 45-65% 2) More than 65%

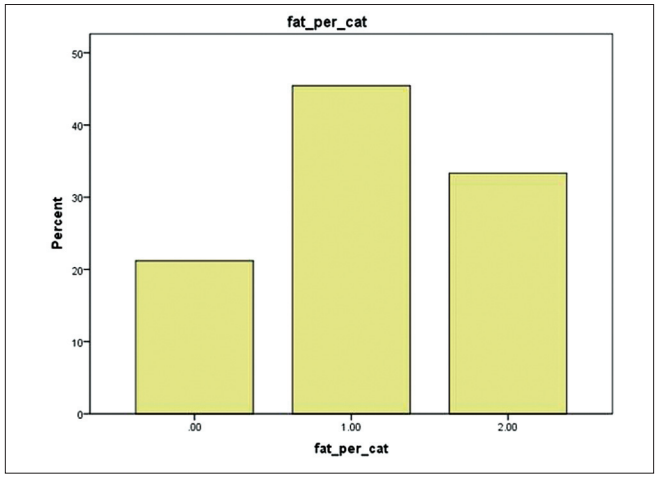

Figure 6: Amount of Fat intake,0) Less than 20%, 1) 20-35%, 2) More than 35%

Another study on 81 women skaters revealed that the mean energy intake in this group was (1958 kcal/d), significantly less than the amounts stated in NHANES III.[17]

The results of different studies showed that the energy intake of female athletes was rarely more than 2880 kcal/d. [16]

In the present study, the mean protein intake in both regions was 17%, carbohydrate intake was 61.85 ± 9.76% and 54.48 ± 6.62% in low and high economic regions and fat was 23.88 ± 8.24% and 30.07 ± 6.68% in low and high economic regions out of total daily energy, respectively.

In a study on women swimmers, the means of protein, fat, and carbohydrate intake were reported as 15%, 32%, and 53%, respectively, all of which corresponded with RDA.[5]

The findings of another study by Lun *et al*. on women with high sports activities showed that the means of protein, fat, and carbohydrate intake were 19%, 28%, and 53% of the total energy intake per day, respectively, which was in line with the findings of the present study. Of course, according to the mentioned study, there is a requirement for nutritional recommendations on protein intake.[6]

A study on women soccer players revealed the mean carbohydrate, fat, and protein intake as 55%, 30%, and 15% of the total daily energy, respectively; the low protein and carbohydrate intake was stated as the results of that study.[16]

A study on women skaters showed that the means of protein, fat, and carbohydrate intake were 15%, 25%, and 60% of total daily energy, respectively, in which carbohydrate intake was less than the amount required for this group (60-70%).[17]

In a study on 72 women professional athletes, the means of macronutrient, protein, fat, and carbohydrate intake were 19%, 31%, and 46% out of the total daily energy, respectively.[7]

Carbohydrate and fat intake in participants of the present study seemed sufficient. However, protein intake was more than the recommended amount; this finding was in line with the findings of recent studies. The high protein intake in these people may be due to the athletes' attitude toward protein consumption. Higher carbohydrate intake in the low economic region can be justified according to the food patterns in low economic regions while high intake of fat in high economic regions seemed normal based on special food patterns of this group, like consuming more fast foods.

The results of this study showed that there was a limitation of energy intake in both economic groups, and the mean of protein intake in both groups was more than the recommended amount.

It should be noted that the results of this study might have been affected by the following factors:

1. The applied software (Nutritionist 4) lacked many popular foods in Iran; therefore, for data analysis, some Iranian foods were inevitably simulated with the foods mentioned in this software, which might have influenced the results.
2. Because the measuring method of food intakes was time consuming (24-hour food recall questionnaire) and also the number of interviewers was low, the study was done in two different seasons of winter and spring and some foods and nutrients are different in these two seasons.
3. The results might have been affected by over- or under-report of the participating individuals.
4. Probably, the participants' briefing at the beginning of their participation in the study, entitled "Investigating and Comparing Energy and Macronutrient Intake in Female Aerobic Athletes in Two Different Socio-economic Regions in City of Isfahan in 2009," has influenced their food reports.
5. Different results of the studies might be attributed to the kind of studied sport.

SUGGESTIONS

1. Studying more participants
2. Using the computer software, which corresponds with local foods

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