

## ORIGINAL ARTICLE

# Dietary Intake, Eating Behaviors and Body Image among Women with and without Polycystic Ovarian Syndrome

Mohsen Mohit<sup>1</sup>, Sahar Fereidouni<sup>1\*</sup>, Najmeh Hejazi<sup>2</sup>

1. Student Research Committee, School of Nutrition and Food Sciences, Shiraz University of Medical Sciences, Shiraz, Iran

2. Clinical Nutrition Department, School of Nutrition and Food Sciences, Shiraz University of Medical Sciences, Shiraz, Iran

## ARTICLE INFO

## Keywords:

Polycystic ovary syndrome  
Dietary intake  
Eating behavior  
Body image  
Woman

## \*Corresponding author:

Sahar Fereidouni,  
Student Research Committee,  
School of Nutrition and Food  
Sciences, Shiraz University of  
Medical Sciences,  
Shiraz, Iran.

Tel: +98-71-37251001

Email: [fereidouni7@gmail.com](mailto:fereidouni7@gmail.com)

Received: November 18, 2019

Revised: February 27, 2020

Accepted: March 15, 2020

## ABSTRACT

**Background:** Polycystic ovary syndrome (PCOS) is the cause of infertility among 75% of women. This study aimed to assess dietary intake, eating behaviors and body image among women with and without PCOS.

**Methods:** Totally, 116 patients with PCOS and 116 subjects without PCOS who referred to Hazrat Zeinab Hospital affiliated to Shiraz University of Medical Sciences, Shiraz, Iran were enrolled. In this cross-sectional, descriptive analytical study, the demographic and 24-hour diet recall, emotional eating (EEQ), and multidimensional body-self relationship (MBSRQ) questionnaires and physical activity were recorded for all participants.

**Results:** The percentage of dietary protein ( $p=0.005$ ) and eicosapentaenoic acid intake ( $p=0.024$ ) in non-PCOS group was significantly higher than PCOS patients. There was a difference between the two groups regarding mean body mass index (BMI) ( $p=0.001$ ), physical activity ( $p=0.327$ ), EEQ ( $p=0.153$ ) and the individual's attitude toward the mental image of their body by MBSRQ ( $p=0.377$ ). No significant difference was noted among PCOS patients regarding carbohydrate, fiber, and saturated fatty acid intake, when compared with non-PCOS group.

**Conclusion:** MBSRQ and EEQ scores were lower among PCOS patients, denoting to the need for investigation on a larger sample size.

Please cite this article as: Mohit M, Fereidouni S, Hejazi N. Dietary Intake, Eating Behaviors and Body Image among Women with and without Polycystic Ovarian Syndrome. Int J Nutr Sci. 2020;5(2):72-78. doi: 10.30476/IJNS.2020.86936.1075.

## Introduction

Polycystic ovarian syndrome (PCOS) is a relatively common disorder among women of childbearing age that is often associated with clinical, metabolic, and hormonal manifestations (1). The syndrome includes a combination of hyperandrogenism (increased male sex hormone), lack of ovulation, and polycystic ovaries (2). In addition to infertility, metabolic problems such as insulin resistance, type 2 diabetes, inflammation, obesity especially

abdominal obesity, metabolic syndrome, and psychological problems such as depression, anxiety, social anxiety, body image disorders, and eating disorders can be seen in PCOS (3).

This syndrome affects about 7% of women of child bearing age and causes infertility among 4-8% of cases (4, 5). About 75% of infertility due to lack of ovulation is attributed to the syndrome (6). According to National Institute of Health report in 2011, the prevalence of PCOS in Iran was shown

to be 7.1% (2). Although the etiology of the disease is not fully understood, it has been suggested that a defect in the hypothalamic-pituitary-adrenal axis or abnormal insulin activity can be the etiology. Risk factors such as obesity, inadequate exercise, family history, and age play important roles in the syndrome (1).

The prevalence of overweight and obesity, especially abdominal obesity, is higher in patients with PCOS, as 50% of women with the syndrome have a high body mass index (BMI). Evidences suggest that these patients are more likely to consume carbohydrates, especially high glycemic index carbohydrates, due to their high levels of androgens, which can increase their daily energy intake (7). Several studies demonstrated that losing 5-10% of weight can improve hormonal and metabolic state, and ultimately lead to ovulation and fertility cycles. Lifestyle changes such as diet modification, physical activity, and dietary behavior as well as weight management are considered as the first line of treatment for the disease (1, 2, 8).

The person's mental image of the body appearance and health status are defined as their mental attitudes towards the body reflecting the thoughts, beliefs, and feelings of each person from his/her body. Negative perception of body image in women with PCOS includes dissatisfaction with the appearance and weight, irregular or non-menstrual periods, hirsutism and acne, and reduced fertility. This negative body image is associated with eating disorders and anxiety too (9).

In these patients, obesity due to eating disorders along with infertility, acne and hirsutism can increase the possibility of their influence on body image (3, 4). Negative emotions happens in an individual may lead to a rise in food intake defined as emotional eating. If a person is repeatedly involved in emotional eating, it can lead to eating disorders such as anorexia, or bulimia nervosa. Some studies have reported a higher prevalence of emotional eating in women with PCOS (10). Elevated testosterone levels cause neurological stimulation and psychosocial disorders in these patients. In women with PCOS, uncontrolled eating, fatigue, and a strong desire to eat certain foods have also been reported (11).

Some researchers reported low levels of self-esteem and body satisfaction for women with PCOS and overweight (9). Morosi and the colleagues evaluated the link between intense food craving, emotional eating, and binge eating with PCOS in obese and overweight women and showed that the score of food craving and binge eating was higher in patients with PCOS (12). Due to the lack of comprehensive study in this field in the literature,

this study aimed to assess dietary intake, eating behaviors and body-image in women with and without PCOS.

## Materials and Methods

A cross-sectional, descriptive-analytical study was performed on women older than 18 years with and without PCOS, who referred to Hazrat Zeinab Hospital in Shiraz, southern Iran. Sampling was undertaken randomly based on the easy access method. The inclusion criteria were female sex, being older than 18 years, and not suffering from chronic diseases such as diabetes, high blood pressure, and cardiovascular diseases. Patients were grouped as those with PCOS and subjects as non-PCOS. A written informed consent was obtained from all participants and the study was approved in our institution. This study was approved by the Local Ethics Committee.

The data were collected by a trained nutritionist through a questionnaire and an interview method. In the demographic questionnaire, personal information such as age, sex, marital status, fertility or abortion history, family history and duration of PCOS and other diseases, and consumption of any medication or supplement were recorded. Weight with the least coverage was measured using a digital scale with an accuracy of 0.1 kg and height was determined without shoes using a meter mounted on the wall with an accuracy of 0.1 cm. Moreover, BMI was obtained by dividing weight in kilograms by the square of height in meters.

The sample size was evaluated using the difference between the mean of the two communities and considering the confidence coefficient of 95% and the power of 80%. Based on a previous study, the food emotion score in the case group was 44 ( $\mu$ L) and the mean in the control group was 37 ( $\mu$ L) (7). So a minimum sample size of 116 patients in each group was considered. Information on food intake was collected through a 24-hour recall questionnaire. Participants were asked to report the amount and type of consumed foods in all three main meals and snacks over a 24-hour period. The consumption values of the individuals were calculated based on the standard consumption sizes and the energy values and neutrinos were calculated by Nutritionist 4 software (version 3.5.2).

Food emotion information was obtained through the emotional eater questionnaire (EEQ) (10). This questionnaire was consisted of 14 questions, including interest in sweets, nuts, fast foods (pizza, burgers, and sandwiches), and high-fat foods; and also the sense of satisfaction with body shape, and the role of exercise in improving the physical condition, and

the role of stress and fatigue in the amount of food intake and the role of diet combination in controlling food intake were recorded.

The questionnaire was scored based on a four-point Likert scale; never (zero point), rarely (one point), sometimes (two points), and always (three points). The mean score of these 14 questions was considered as the individual's food feeling/emotion score. So the higher the person's nutritional score, the more control they can have over their eating behavior. The questionnaire was translated into Persian and both the content and face validity of the questionnaire was measured qualitatively, while the reliability was computed using Cronbach's alpha coefficient. The computed reliability index was considered 0.76 indicating the internal stability of the questionnaire to be acceptable as a research tool.

To evaluate the participants' attitudes toward body self-image dimensions, MBSRQ was used related to an individual's thoughts, feelings, and behavior. The MBSRQ was developed in 1990 consisted of 46-item test including appearance assessment and orientation, fitness assessment and orientation, health assessment and orientation, disease orientation, physical satisfaction, mental weight, and overweight conflicts based on a 5-point Likert scale (completely opposite=1 to fully agree=5) (11).

The metabolic equivalent of task questionnaire (MET) was also completed to calculate the participants' physical activity levels (9). SPSS software (version 19, Chicago, IL, USA) was used to analyze the data. After checking that the data distribution was normal using the Kolmogorov-Smirnov test, an independent sample t-test was used to compare quantitative data between the two groups. To compare the two groups concerning the classified data, Chi-square test was used.  $p$  less than 0.005 was considered as a significant level.

## Results

A total of 232 women participated in this study, of whom, 116 (50%) suffered from PCOS and in 116 (50%), the syndrome was absent. The mean age

in PCOS group was 31.62 years and in non-PCOS group was 55.45 years. Also, the mean weight in PCOS group was 63.80 kg and in non-PCOS group was 63.70 kg. There was no significant difference between the two groups regarding the mean BMI, physical activity ( $p=0.327$ ), emotional eating score (EEQ) ( $p=0.153$ ), and individual attitude to body image (MBSRQ) ( $p=0.377$ ) (Table 1).

The family history of PCOS was significantly higher in PCOS group, while the history of fertility in non-PCOS group was significantly higher. There was no significant difference in the history of marriage, and abortion in the two groups. The consumption of oral contraceptive pills ( $p=0.0001$ ), metformin ( $p=0.0001$ ), estradiol ( $p=0.029$ ), folic acid supplement ( $p=0.030$ ) and iodine supplement ( $p=0.005$ ) was significantly higher in PCOS group, however, the history taking of multivitamins, iron, zinc, calcium, vitamin D3, and vitamin E supplementation in the two groups was not significantly different.

The comparison of dietary components between the two groups indicated that the dietary protein percentage in non-PCOS group was significantly higher than the PCOS group ( $p=0.005$ ). Also, the intake of eicosapentaenoic acid (EPA- $\omega$ -3-FA) was significantly higher in non-PCOS group ( $p=0.024$ ). Other dietary indicators did not differ significantly between the two groups (Table 2).

Table 3 assessed the components of a MBSRQ about the self-mental image of the body stating that the 10 components of this questionnaire (appearance evaluation and orientation, fitness evaluation and orientation, health evaluation, illness orientation, body-areas orientation, overweight preoccupation, and self-classified weight) were significantly higher in non-PCOS group. Other indicators of this questionnaire were not significantly different between the two groups.

## Discussion

The comparison of the mean food score in the two studied groups showed no significant difference between PCOS and non-PCOS groups ( $p=0.153$ ).

**Table 1:** Personal information, anthropometric indices, physical activity, emotional eating score and the mental image of the body between two groups.

Variable	PCOS group	Non-PCOS group	$p$ value
Age (years)	31.62±6.28	35.45±25.5	0.0001
Weight (kg)	63.80±11.1	63.70±9.75	0.945
Body Mass Index (Kg/m <sup>2</sup> )	24.11±4.33	24.01±3.98	0.0001
Physical activity (MET/h)	67.62±33.2	37.25±4.57	0.327
EEQ (Score)	18.43±4.81	19.33±4.71	0.153
MBSRQ (Score)	242.47±25.04	245.25±22.81	0.377

Mean of non-parametric data were obtained by Mann-Whitney u test and parametric data were obtained by independent sample t-test (mean±SE). PCOS: Polycystic ovary syndrome, EEQ: Emotional eating questionnaire, MBSRQ: Multidimensional body-self relations questionnaire.

**Table 2:** Food intake information among two groups.

Variable	PCOS group	Non-PCOS group	p value
Energy (Kcal)	1621.4±708.81	1569.5±545.08	0.532
Protein (g)	56.9±26.32	60.14±25.88	0.359
Protein percentage (%)	13.85±3.24	15.44±5.14	0.005
Carbohydrate (g)	113.15±26.2	93.85±24.7	0.219
Carbohydrate (%)	64.77±10.55	62.91±11.8	0.207
Fat (g)	41.4±30.73	39.75±26.59	0.657
Fat percentage (%)	21.22±10.14	62.91±9.64	0.832
Saturated fat (g)	11.36±1.42	9.18±1.35	0.575
EPA (g)	0.013±0.002	0.045±0.012	0.024
Soluble fiber (g)	2.54±0.32	2.48±0.284	0.410
Dietary fiber (g)	6.28±1.21	5.85±1.07	0.074

Mean of non-parametric data were obtained by Mann-Whitney u test and parametric data were obtained by independent sample t-test (mean±SE). EPA: Eicosapentaenoic acid, PCOS: Polycystic ovary syndrome.

**Table 3:** Information on the components of the multidimensional body self-relationship questionnaire (MBSRQ) between two groups.

Variable	PCOS group	Non-PCOS group	p value
Appearance evaluation	26.87±3.92	27.99±4.18	0.037
Appearance orientation	44.19±6.47	45.04±7.54	0.356
Fitness evaluation	11.01±2.59	11.09±2.96	0.832
Fitness orientation	44.08±7.27	45.16±7.31	0.262
Health evaluation	18.97±3.71	21.16±3.43	0.000
Health orientation	28.90±4.57	29.58 ± 4.28	0.243
Illness orientation	18.80±4.61	19.47±4.29	0.258
Body-areas orientation	7.98±3.64	8.45±4.16	0.008
Overweight preoccupation	6.53±1.27	6.66±1.37	0.564
Self-classified weight	10.36±1.66	10.16±1.51	0.700

Mean of non-parametric data were obtained by Mann-Whitney u test and parametric data were obtained by independent sample t-test (mean±SE). MBSRQ: Multidimensional body-self relations questionnaire, PCOS: Polycystic ovary syndrome.

The attitudes toward eating using the Eating Attitude Test questionnaire was investigated and shown that there was no significant difference between the two groups of PCOS and non-PCOS patients (13). In Lee *et al.*'s multivariate modeling, the EDE-Q abnormal score was associated with PCOS. However, the prevalence of bulimia nervosa (BN), binge eating disorder (BED), and night eating syndrome (NES) in women with PCOS did not differ significantly from non-PCOS patients (14).

The results of a study by Morosi *et al.* showed that food craving scores and binge eating were higher in patients with PCOS than healthy women (15). A meta-analysis study of eating disorders in women with PCOS revealed that women with PCOS had more chance of getting higher eating disorder score and special ED diagnoses than the control group. This study also suggested the implementation of screening programs for eating disorders in the demographic group of these patients (16).

Our results showed that total energy, energy intake from carbohydrates, fat, and dietary protein

content were not significantly different in the two groups. In contrast to the results of the present study, Gregory *et al.* reported that dietary intake of energy, carbohydrates, fats, and protein was significantly different in the two groups of patients with and without PCOS (17). The current results indicated that the percentage of energy received from the dietary protein in the group of patients was significantly lower ( $p<0.05$ ).

Doulas *et al.* did not report a significant difference in the percentage of energy received from dietary protein between the two groups of patients with PCOS and the control group. Also, contrary to the present results, it has been reported that the energy intake from carbohydrates was significantly higher in PCOS group and the same as the present study, there was no significant difference between energy intake from fat, saturated fatty acids and unsaturated fatty acids in PCOS and non-PCOS groups (18).

In contrast to the findings of the present study, it was demonstrated that the amount of fat and protein intake during the day was significantly lower in PCOS



women (19). Contrary to the popular belief that the consumption of saturated fats and dietary fibers was lower in women with PCOS (20), the present results indicated a significant difference in dietary intake of these two factors in both groups. Higher levels of androgens can be the reason for the increased tendency to consume carbohydrates in women with PCOS, but this hypothesis has been challenged by the lack of significance in carbohydrate consumption in the two groups studied in this study.

Lifestyle changes, such as intake of weight-loss diets, are one of the most effective treatments for these patients, and various studies have reported improvements in infertility, insulin resistance, and hyper-androgenism following weight loss in these patients. Reducing the feeling of fullness has challenged energy-restricted diets in these patients (21-23). Therefore, changes in dietary composition, including an increase in the percentage of dietary protein, which is one of the recommended diets for weight loss, can be considered in these patients. High-protein, low-energy, and low-carbohydrate diets can lead to a decrease in fat mass and an increase in fat-free mass (24).

Therefore, high-protein diets can be considered as a suitable treatment strategy in these patients. In PCOS patients, increased estrogen secretion, which is the result of irregular steroid production, has been shown to cause hyper-androgenism (25). Some researchers have found that supplementation with omega-3 fatty acids helps reducing androgens in these patients (26). In this study, PCOS patients had significantly lower omega-3 intake than non-PCOS patients. Although comparing the scores obtained from the MBSRQ did not make a significant difference between PCOS and non-PCOS patients, the three factors of this questionnaire, including appearance and health assessments and physical satisfaction were significantly lower in PCOS patients.

Karacan *et al.* reported that there was no significant difference in physical dissatisfaction between PCOS and the control group (13). Physical dissatisfaction can lead to lower self-esteem, depression, and eating disorders (27). Several researchers have shown that women with PCOS are prone to physical dissatisfaction and other mental disorders, including depression and anxiety (28). Due to the metabolic conditions in PCOS patients, they generally have overweight, obesity, hirsutism, and acne, which can affect physical dissatisfaction and lead to eating disorders among them (29).

Some of the limitations of this study were the small sample size, and the use of 24-hour diet recall. So, it is recommended that future studies

to use a larger sample size, other questionnaires that can assess emotional well-being, physical satisfaction, and the food frequency questionnaire (FFQ) assessing the diet. It is also recommended that analytical observational studies and meta-analysis reviews to be designed.

## Conclusion

Although some components of MBSRQ, such as physical satisfaction and evaluation, and appearance evaluation were significantly lower PCOS group, the individual's attitudes toward MBSRQ and EEQ were significantly different between the two groups. Contrary to the previous assumptions in dietary intake, especially carbohydrates, fibers, and saturated fatty acids, there was no significant difference in these factors in PCOS patients. However, the percentage of energy received from protein and EPA was significantly lower in patients with PCOS. More studies are needed to judge the studied factors in the present research.

## Acknowledgment

This article was financially supported by Shiraz University of Medical Sciences, Shiraz, Iran (project No. 95-01-21-1317). The authors like to thank Shiraz University of Medical Science for financial support of this project.

## Conflict of interest

None declared.

## References

- 1 Kataoka J, Tassone EC, Misso M, et al. Weight management interventions in women with and without PCOS: A systematic review. *Nutrients*. 2017;9:996. DOI:10.3390/nu9090996. PMID:28885578.
- 2 Amiri M, Ramezani Tehrani P, et al. Effect of Interventions Based on Lifestyle Modification on Clinical, Hormonal, and Metabolic Findings in the Patients with Polycystic Ovary Syndrome: A Systematic Review. *Iran J Endocrin Metab*. 2016;17:489-500.
- 3 Farrell K, Antoni MH. Insulin resistance, obesity, inflammation, and depression in polycystic ovary syndrome: biobehavioral mechanisms and interventions. *Fertil Steril*. 2010;94:1565-74. DOI:10.1016/j.fertnstert.2010.03.081. PMID:20471009.
- 4 Blay SL, Aguiar JVA, Passos IC. Polycystic ovary syndrome and mental disorders: a systematic review and exploratory meta-analysis. *Neuropsychiatr Dis Treat*. 2016;12:2895-2903. DOI:10.2147/NDT.S91700. PMID:27877043.

- 5 Shishehgar F, Tehrani FR, Mirmiran P, et al. Factors influencing physical activity in women with polycystic ovary syndrome in comparison to eumenorrheic non hirsute women. *Glob J Health Sci.* 2016;8:56382. DOI:10.5539/gjhs.v8n10p127. PMID:27302456.
- 6 Dayani Siriwardene SA, Karunathilaka LP, Kodituwakku ND, et al. Clinical efficacy of Ayurveda treatment regimen on Subfertility with Poly Cystic Ovarian Syndrome (PCOS). *Ayu.* 2010;31:24-7. DOI:10.4103/0974-8520.68203. PMID:22131680.
- 7 Larsson I, Hulthén L, Landén M, et al. Dietary intake, resting energy expenditure, and eating behavior in women with and without polycystic ovary syndrome. *Clin Nutr.* 2016;35:213-8. DOI:10.1016/j.clnu.2015.02.006. PMID:25743212.
- 8 Akshaya S, Bhattacharya R. Comparative study of clinical profile of lean and obese polycystic ovary syndrome women. *Int J Reprod Contracept Obstet Gynecol.* 2016;5:2530-3. DOI:10.18203/2320-1770.ijrcog20162173.
- 9 Ainsworth BE, Haskell WL, Witt MC, et al. Compendium of Physical Activities: an update of activity codes and MET intensities. *Med Sci Sports Exerc.* 2000;32:S498-504. DOI:10.1097/00005768-200009001-00009. PMID:10993420.
- 10 Garaulet M, Canteras M, Morales E, et al . Validation of a questionnaire on emotional eating for use in cases of obesity: the Emotional Eater Questionnaire (EEQ). *Nutr Hosp.* 2012;27:645-51. DOI:10.1590/S0212-16112012000200043. PMID:22732995.
- 11 Brown TA, Cash TF, Mikulka PJ. Attitudinal Body-Image Assessment: Factor analysis of the body-self relations questionnaire. *J Pers Assess.* 1990;55:135-44. DOI:10.1080/00223891.1990.9674053. PMID:2231236.
- 12 Michelmor K, Balen A, Dunger D. Polycystic ovaries and eating disorders: are they related? *Hum Reprod.* 2001;16:765-9. DOI:10.1093/humrep/16.4.765. PMID:11278230.
- 13 Karacan E, Caglar GS, Gürsoy AY, et al . Body satisfaction and eating attitudes among girls and young women with and without polycystic ovary syndrome. *J Pediatr Adolesc Gynecol.* 2014;27:72-7. DOI:10.1016/j.jpog.2013.08.003. PMID:24602301.
- 14 Lee I, Cooney LG, Saini S, et al. Increased risk of disordered eating in polycystic ovary syndrome. *Fertil Steril.* 2017;107:796-802. DOI:10.1016/j.fertnstert.2016.12.014. PMID:28104244.
- 15 Morosi A, Jeanes Y. Food cravings, binge eating and emotional eating behaviours in overweight and obese women with polycystic ovary syndrome. *Proc Nutr Soc.* 2017;76. DOI:10.1017/S0029665117000155.
- 16 Lee I, Cooney LG, Saini S, et al . Increased odds of disordered eating in polycystic ovary syndrome: A systematic review and meta-analysis. *Eat Weight Disord.* 2019;24:787-97. DOI:1018-0533-y. PMID:29947018.
- 17 Pourghassem Gargari B, Houjehani S, Mahboob S, et al . Assessment of nutrients intake in polycystic ovary syndrome women compared to healthy subjects. *Iran J Obstet Gynecol Infertil.* 2011;14:1-8.
- 18 Douglas CC, Norris LE, Oster RA, et al . Difference in dietary intake between women with polycystic ovary syndrome and healthy controls. *Fertil Steril.* 2006;86:411-7. DOI:10.1016/j.fertnstert.2005.12.054. PMID:16762348.
- 19 Larsson I, Hulthén L, Landén M, et al . Dietary intake, resting energy expenditure, and eating behavior in women with and without polycystic ovary syndrome. *Clin Nutr.* 2016;35:213-8. DOI:10.1016/j.clnu.2015.02.006. PMID:25743212.
- 20 Hatfield JA. Comparison of dietary intake between obese, post-obese, and normal weight women [Master thesis]. Birmingham (AL): University of Alabama at Birmingham, 2000.
- 21 Tolino A, Gambardella V, Caccavale C, et al. Evaluation of ovarian functionality after a dietary treatment in obese women with polycystic ovary syndrome. *Eur J Obstet Gynecol Reprod Biol.* 2005;119:87-93. DOI:10.1016/j.ejogrb.2004.06.043. PMID:18734091.
- 22 Holte J, Bergh T, Berne C, et al. Restored insulin sensitivity but persistently increased early insulin secretion after weight loss in obese women with polycystic ovary syndrome. *J Clin Endocrinol Metab.* 1995;80:2586-93. DOI:10.1210/jcem.80.9.7673399. PMID:7673399.
- 23 Moran LJ, Noakes M, Clifton PM, et al. Ghrelin and measures of satiety are altered in polycystic ovary syndrome but not differentially affected by diet composition. *J Clin Endocrinol Metab.* 2004;89:3337-44. DOI:10.1210/jc.2003-031583. PMID:15240612.
- 24 Krieger JW, Sitren HS, Daniels MJ, et al. Effects of variation in protein and carbohydrate intake on body mass and composition during energy restriction: a meta-regression 1. *Am J Clin Nutr.* 2006;83:260-74. DOI:10.1093/ajcn/83.2.260. PMID:16469983.
- 25 Caron MF, White CM. Evaluation of the antihyperlipidemic properties of dietary supplements. *Pharmacotherapy.* 2001;21:481-

7. DOI:10.1592/phco.21.5.481.34499. PMID:11310521.
- 26 Nadjarzadeh A, Firouzabadi RD, Vaziri N, et al. The effect of omega-3 supplementation on androgen profile and menstrual status in women with polycystic ovary syndrome: A randomized clinical trial. *Iran J Reprod Med.* 2013;11:665-72. PMID:24639805.
- 27 Stice E, Whittenton K. Risk factors for body dissatisfaction in adolescent girls: A longitudinal investigation. *Dev Psychol* . 2002;38:669-78. DOI:10.1037//0012-1649.38.5.669. PMID:12220046.
- 28 Barry JA, Kuczmierczyk AR, Hardiman PJ: Anxiety and depression in polycystic ovary syndrome: a systematic review and meta-analysis. *Hum Reprod.* 2011;26:2442-51. DOI.10.1093/humrep/der197. PMID:21725075.
- 29 Michelmore KF, Balen AH, Dunger DB. Polycystic ovaries and eating disorders: are they related? *Hum Reprod.* 2001;16:765-9. DOI:10.1093/humrep/16.4.765. PMID:11278230.