The Pharma Innovation Journal 2021; 10(10): 684-689

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; 10(10): 684-689

www.thepharmajournal.com
Received: 19-07-2021
Accepted: 27-08-2021

Megha M Katte
Department of Food Science Nutrition, UAS, GKVK, Bengaluru, Karnataka, India

Vijayalakshmi D
Department of Food Science Nutrition, UAS, GKVK, Bengaluru, Karnataka, India

Ganga Jyothi
Department of Food Science Nutrition, UAS, GKVK, Bengaluru, Karnataka, India

Corresponding Author:
Megha M Katte
Department of Food Science Nutrition, UAS, GKVK, Bengaluru, Karnataka, India

Food habits and dietary intake of women with poly cystic ovarian syndrome

Megha M Katte, Vijayalakshmi D and Ganga Jyothi

Abstract
Polycystic Ovary syndrome (PCOS) is a endocrine disorder affecting women of reproductive age. Though most of PCOS women are obese, there is limited data investigating the diet composition of PCOS women. The goals of treatment are weight loss, improved hormonal and reproductive function, prevention of metabolic disorders and improved quality of life. Present study aims at comparing the dietary intakes (food habits, macronutrients, and micronutrients) between PCOS women and controls. The results show that about, 26 per cent in CP, 36 per cent in NP and 34 per cent in CN group consumed meat and meat products. It was observed among the non-vegetarians that they do not prefer lean meat for consumption. Meal pattern reveals that 36 per cent of the CP group women were in a habit of skipping a meal in their daily diet, followed by, 26 per cent in NP and 12 per cent in CN group. Cereal consumption is relatively high and pulse consumption is relatively low when compared to RDA. The lowest percent adequacy was found for β-carotene *i.e.* 28 per cent in CP. Behavioural habits like, lack of concentration and consumption of large meals, inappropriate meal patterns, and skipping meals seem to be worsening the condition. This research through presenting an image of food habits in women with PCOS can help for designing the necessary interventions to change the food habits, control the symptoms and complications of PCOS, and finally, improve the reproductive health of these young women.

Keywords: PCOS, food habits, dietary intake, nutrient adequacy, case control study

Introduction
Polycystic Ovary syndrome (PCOS) is a endocrine disorder affecting women of reproductive age. The short and long term consequences of this disorder, impacts on general and mental health, in addition to imposing heavy financial burdens on society (Azziz *et al*., 2005) [1].
The goals of treatment are weight loss, improved hormonal and reproductive function, prevention of metabolic disorders and improved quality of life (Moran *et al*., 2011) [18]. The high cost of treatments and consequent complications have motivated researchers to identify the modifiable risk factors associated with this syndrome (Chavarro *et al*., 2007) [4]. Although more than 50% of PCOS women are obese, there is limited data investigating the diet composition of PCOS women (Douglas *et al*., 2006) [6].
Some studies report no difference in macronutrient and energy intake in women with and without PCOS (Douglas *et al*., 2006, Wright *et al*., 2004) [6, 24]. In a recent study, higher intakes of fiber and micronutrients and lower intakes of food with a high glycemic index (GI) and saturated fatty acid have been reported in PCOS women as compared to controls (Moran *et al*., 2013) [19]. Furthermore, studies dietary intake in PCOS women, have reported higher intakes of saturated fat, and GI diet and lower intakes of fibercompared to controls (Douglas *et al*., 2006; Colombo *et al*, 2009) [6, 5].
Since food habits are rooted in the culture of each region of the world (Cassel, 1957) [3] and the relationship between dietary habits and incidence of some cardiovascular disease and type 2 diabetes has been demonstrated, it is essential to compare dietary habits of PCOS women with age-BMI matched controls to design appropriate dietary intervention. The aim of this study is to compare the dietary intakes (food habits, macronutrients, and micronutrients) between PCOS women and controls.

Material and Methods
Locale of the study: The study was conducted in Kempegowda Institute of Medical Sciences (KIMS), affiliated to Rajiv Gandhi University of Health Science, Jayanagar, Bengaluru under the supervision of gynaecologists and dietician of the hospital.
Selection of the subjects: For the present study young women in the age group of 18-25

years were considered. Those who reported at least one Rotterdam criteria were classified as symptomatic and were further diagnosed for other symptoms. Women with classic PCOS (characterized by clinical hyperandrogenism, anovulation and ovarian cysts) and normandrogenic PCOS (characterized by anovulation and ovarian cysts) were considered along with age matched women without PCOS (those who did not exhibit at least two PCOS characteristics) as control.

The total sample size was 150 with 50 members in each group

1. Classic PCOS group (CP) with Anouvulation, Hyperandrogenism and Polycystic ovaries
2. Normandrogenic PCOS group (NP) with Anouvulationand Polycystic ovaries and
3. Control group (CN) without hyperandrogenism and Polycystic ovaries.

Ultrasounds were not carried out on women who did not present with clinical symptoms of PCOS, as was also the case in an Asian community study of PCOS prevalence. There may have been some women in this group who had hyperandrogenism and polycystic ovaries but literature suggests this is likely to be less than 1 per cent of those with PCOS (Kumarapeli *et al.*, 2008) [14].

Dietary assessment

Dietary intake in terms of food and nutrients was assessed for all women through 24-hour recall method. Baseline diet survey of the selected subjects was conducted by using 24 hours recall method for three days (two weekdays and one weekend) using standardized vessels, cups and paper discs. Respondents were asked to recall the type of preparation made for breakfast, lunch, snack, dinner etc. for the previous day (other than fasting and feasting day).

Information on raw ingredients used for each preparation and also on the total cooked amount of each preparation was recorded in terms of standardized tools. The average raw ingredients in all the meals consumed by each respondent per day were calculated. The schedules were properly sorted out after verification and serially numbered. Data on intake of foods - cereals, pulses, milk and milk products, fruits and vegetables, oils, fats, and sugars were quantified. Using the quantity of foods consumed per day intake of calories, protein, fat, energy, fiber, calcium, iron, β-carotene and vitamin C were calculated using tables of Nutritive Value of Indian Foods (Longvah *et al*., 2017) [15]. These figures were compared against RDA for adult women as per the revised requirements suggested by the ICMR to provide a measure of adequacy or inadequacy of food and nutrient consumption (ICMR, 2010) [13].

$$\text{Per cent nutrient adequacy} = \frac{\text{Intake of each nutrient}}{\text{Recommended dietary allowances}} \text{ X } 100$$

Dietary habits and meal pattern were also recorded.

Results and Discussion

Food habits of the subjects: As depicted in Table 1, low percentage of women 2, 4 and 8 per cent of the women were vegan in CP, NP and CN group respectively who did not consume any type of food from the animal source.

In the CN group, 40 per cent of the women were lacto vegetarians. Fifty per cent of the CP group were ovo-lacto vegetarians who consumed milk and milk products along with egg. It was found during the study period that the subjects who used to be lacto-vegetarians have shifted to ovo-lacto vegetarians considering it as source of protein. Few subjects, also believed that egg consumption helps in weight loss due to its high protein content and few reported that they relish various delicacies of egg. But were unaware of the cholesterol content in egg or about the quantity to be consumed to attain health benefits. About, 26 per cent in CP, 36 per cent in NP and 34 per cent in CN group consumed meat and meat products. It was observed among the non-vegetarians that they do not prefer lean meat for consumption.

Meal pattern of the subjects: In addition to this, the meal pattern of the subjects was studied (Table 2). The table shows that 36 per cent of the CP group women were in a habit of skipping a meal in their daily diet, followed by, 26 per cent in NP and 12 per cent in CN group. The percentage of women who ate all the three meals was relatively high in non PCOS group.

As the study participants were mostly college going girls and are of young age, they tended to eat outside every day as they could easily access and afford outside food.

Average food intake of the subjects: The mean consumption of different food stuff of women is depicted in Table 3. Here it showed that, cereal consumption adequacy was above the RDA (115% in CP, 108% in NP and CN). Pulse consumption was found to be below the RDA in all the three groups (56%, 63%, 68% in CP, NP and CN respectively). Whereas percent adequacy of sugar was found to be 125 per cent, 129 per cent and 118 per cent in CP, NP and CN respectively, which is above the RDA. Fat consumption was found to be 126 per cent in CP, 133 per cent in NP, 112 per cent in CN in comparison to the RDA. Consumption of roots and tubers, GLVs other vegetables and fruits was found to be below the RDA in all the three groups whereas in the CN group the consumption of these food groups was relatively high (Fig 1). The statistical analysis showed that, there was significant difference in amount of food consumed within the group. The probable reason for the inadequate intake of quantity of pulses, milk and milk products, root and tuber, fruits and vegetables might be due to lack of nutrition knowledge among the subjects. Similar findings were made by Shishehgar *et al.*, 2016 [22] that low consumption of legume was observed in PCOS subjects (p=0.026).

The low intake of fruits and vegetables was reflected in terms of poor micro nutrient intake of the study participants. Preetha and Ramaswamy 2013 [20] also have reported the low consumption of vegetables and fruits (32% and 15% respectively) among the PCOS subjects.

The results are on par with the findings of Misir and Ines Banjari 2016 and Huigen *et al.*, 2017 [17, 12] who reported the increased consumption of fat and sugar and relatively less consumption of protective foods among PCOS subjects compared to control group.

Average nutrient intake of the subjects: The quantity of nutrient intake consumed by respondents were recorded during the study period and the mean nutrient intake was compared with the recommended dietary allowance of women are depicted in Table 4.

The mean nutrient intake with respect to energy was almost

similar across the group (102% in CP, 101% in NP and 99% in CN). Whereas the percent adequacy of protein was 71 per cent, 74 per cent in CP and NP groups respectively. The amount of fat consumed was 159% of RDA in CP group, 164 per cent of RDA in NP group and 146 per cent of RDA in CN group (Fig 2). Douglas *et al.*, 2006 [6] has also reported that there was no significant difference across the group with respect to total energy consumption.

Calcium is an important nutrient for powerful muscle contraction, bone structure maintenance. Nerve signaling are calcium dependent physiological processes. Intake of calcium among respondents was found to be below the RDA in all the three groups.

This can be due to less consumption of milk and milk products. The percent adequacy for iron was also below the RDA in all the three groups but the consumption was significantly different within the group. Low iron consumption will influence the hemoglobin content of the blood. Anemia can also be one of the reasons for delayed menstrual cycle. Decreased micronutrient intake among PCOS subjects is reported by Douglas *et al.*, 2006 [6], and Rajashekhar *et al.* 2008 [21].

The lowest percent adequacy was found for β-carotene *i.e.* 28 per cent in CP. This may be due to inadequate yellow and orange fruits, green leafy vegetables and milk products in the diet. The average vitamin C intake was found to be below the RDA in all the three groups. This may be due to inadequate consumption of green leafy vegetables and fruits especially citrus fruits.

It has to be noted that, though there is no significant difference with respect to energy consumption across the group. But the amount of fat consumed is significantly different in PCOS and control group. This shows that, fat is contributing more for the total calories in PCOS group, indicating the poor-quality diet. The reason as observed in Table 2. might be the choice of outside food, especially fried and processed food choices of PCOS subjects. Even though the consumption of macro and micro nutrientsis better in control group the per cent inadequacy is still below the recommended dietary allowance.

PCOS women in the study were less likely to eat for necessity and more because of emotional disturbances. Leading to a progressively increasing caloric intake. This may represent a tendency to bulimic eating pattern, a behaviour that has been shown to be common among women with PCOS (Eleftheriadou *et al*., 2015) [7]. The deleterious effects of poor eating habits on general health are well known, leading to heart disease, diabetes and other metabolic disorders. In patients with diagnosed PCOS, this may be more detrimental, given their genetic tendency to metabolic syndrome including infertility.

Table 1: Food habits of the subjects (N = 150)

Category	CP (n = 50)		NP (n = 50)		CN (n = 50)	
	No.	%	No.	%	No.	%
Vegan	1	2.00	2	4.00	4	8.00
Lacto vegetarian	11	22.00	15	30.00	20	40.00
Ovolacto vegetarian	25	50.00	15	30.00	9	18.00
Non-vegetarian	13	26.00	18	36.00	17	34.00

CP – Classic PCOS, NP – Normandrogenic PCOS, CN – Control

Table 2: Meal pattern of the subjects (N = 150)

Meal pattern	Category	CP (n = 50)		NP (n = 50)		CN (n = 50)	
		No.	%	No.	%	No.	%
Meals consumed per day	Twice	18	36.00	13	26.00	5	10.00
	Thrice	32	64.00	37	74.00	44	88.00
Meal skipped	Breakfast	3	6.00	7	14.00	3	6.00
	Lunch	6	12.00	4	8.00	0	0.00
	Dinner	9	18.00	2	4.00	2	4.00
Reasons for skipping particular meal@	Not hungry	10	20.00	5	10.00	1	2.00
	Do not have time to eat	4	8.00	7	14.00	4	8.00
	Do not have time to cook	1	2.00	0	0.00	0	0.00
	Do not like particular food	1	2.00	2	4.00	5	10.00
	Munching in between	13	26.00	8	16.00	2	4.00
Preferred choice while eating outside@	Steamed	7	14.00	10	20.00	13	26.00
	Baked	28	56.00	33	66.00	30	60.00
	Fried	43	86.00	47	94.00	28	56.00
	Processed	48	96.00	23	46.00	25	50.00
	Healthy choice	14	28.00	11	22.00	20	40.00

CP – Classic PCOS, NP – Normandrogenic PCOS, CN – Control, @ - multiple response

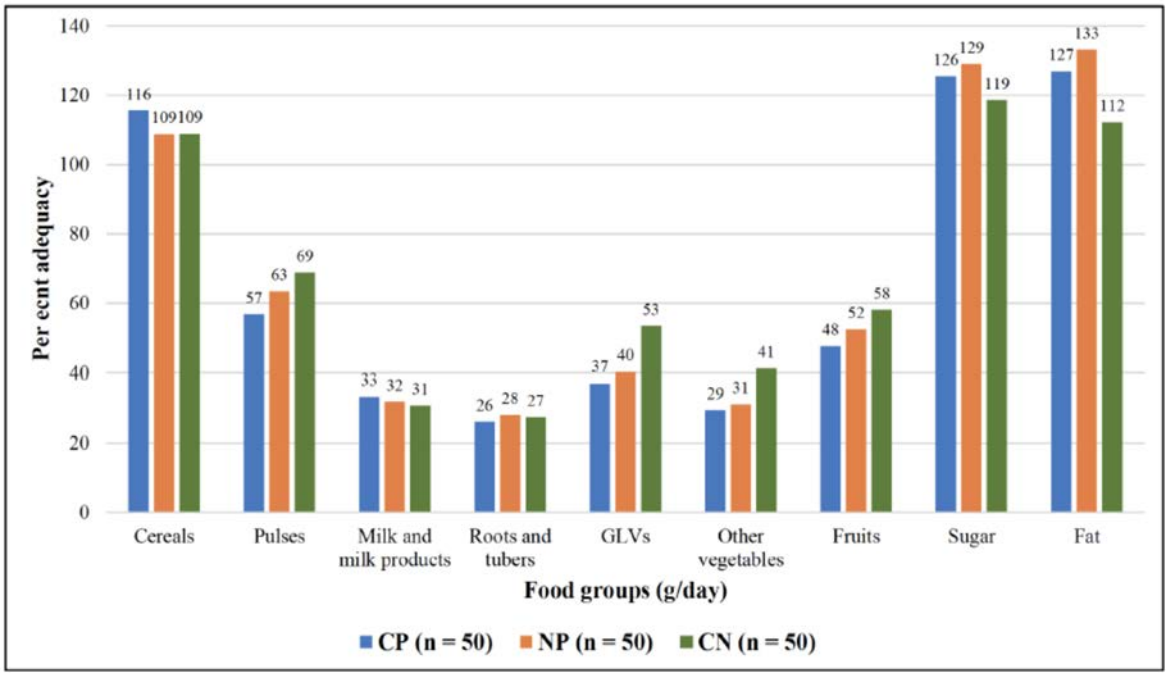

Fig 1: Per cent adequacy of food intake of the subjects

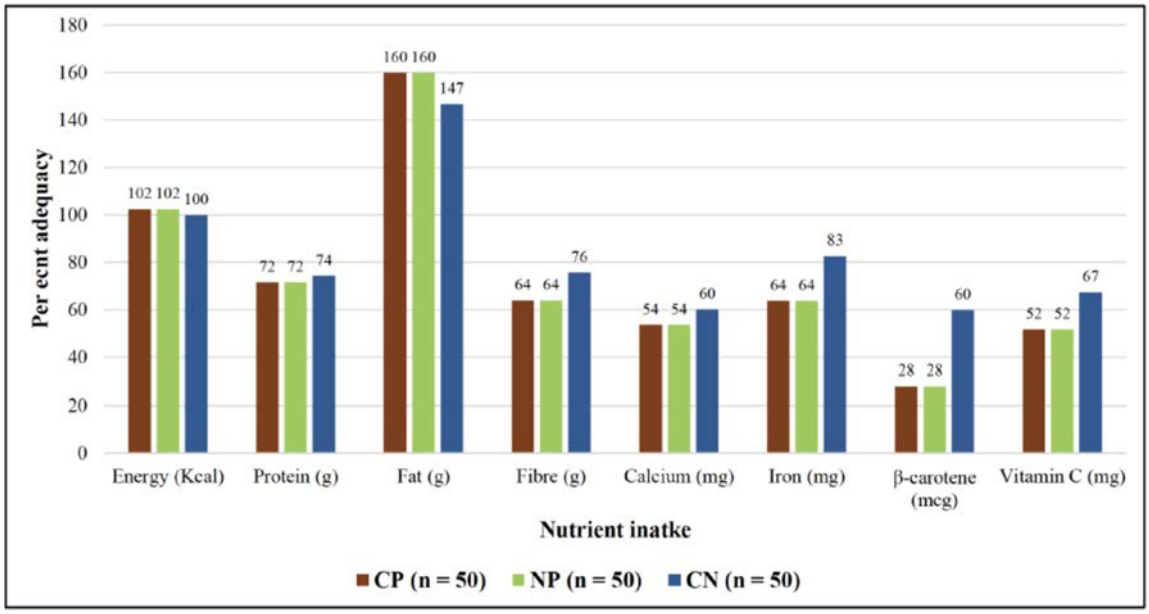

Fig 2: Per cent adequacy of nutrient intake of the subjects

Table 3: Average food intake of the subjects (N = 150)

Food groups (g/day)	RDA# (g/day)	CP (n = 50)			NP (n = 50)			CN (n = 50)		
		Actual intake	% adequacy	'Z' test	Actual intake	% adequacy	'Z' test	Actual intake	% adequacy	'Z' test
Cereals	270	312.20 ± 29.06	115.63	10.27**	293.80 ± 21.69	108.81	7.76**	293.98 ± 15.21	108.88	11.15**
Pulses	60	34.08 ± 6.72	56.80	27.27**	38.07 ± 5.22	63.45	29.69**	41.36 ± 4.80	68.93	27.43**
Milk and milk products	300	99.68 ± 22.35	33.23	63.54**	95.68 ± 27.72	31.89	52.13**	92.52 ± 33.47	30.84	43.83**
Roots and tubers	200	52.19 ± 8.88	26.09	117.68**	56.34 ± 12.39	28.17	82.01**	54.94 ± 10.26	27.47	100.02**
GLVs	100	37.06 ± 10.07	37.06	44.21**	40.24 ± 11.58	40.24	36.48**	53.46 ± 11.93	53.46	27.58**
Other vegetables	200	58.97 ± 12.98	29.49	76.83**	62.44 ± 10.14	31.22	95.89**	82.56 ± 14.58	41.28	56.96**
Fruits	100	47.62 ± 11.63	47.62	31.86**	52.44 ± 8.97	52.44	37.49**	58.14 ± 6.94	58.14	42.65**
Sugar	20	25.10 ± 4.85	125.50	7.43**	25.82 ± 3.34	129.10	12.33**	23.72 ± 3.22	118.60	8.18**
Fat	20	25.38 ± 4.19	126.90	9.08**	26.63 ± 3.10	133.15	15.10**	22.45 ± 2.78	112.25	6.23**

CP – Classic PCOS, NP – Normandrogenic PCOS, CN – Control
** - significant at 1% level, # - NIN, Dietary guidelines for Indians (2010)

Table 4: Average nutrient intake of the subjects (N = 150)

Nutrients	RDA#	CP (n = 50)			NP (n = 50)			CN (n = 50)			'F' Value
		Actual intake	% adequacy	'Z' test	Actual intake	% adequacy	'Z' test	Actual intake	% adequacy	'Z' test	
Energy (Kcal)	1900	1944.48 ± 200.90	102.34	1.57 NS	1925.52 ± 144.65	101.34	1.24 NS	1898.80 ± 114.66	99.94	-0.07 NS	1.06 NS
Protein (g)	55	46.51 ± 7.85	71.56	7.65**	48.25 ± 9.64	74.24	4.95**	48.32 ± 10.04	74.33	11.75**	-4.71 NS
Fat (g)	25	39.98 ± 5.26	159.93	20.13**	41.00 ± 3.57	164.00	31.68**	36.70 ± 3.57	146.80	23.20**	14.24**
Fibre (g)	30	19.17 ± 1.83	63.89	41.81**	20.16 ± 1.47	67.19	47.50**	22.70 ± 1.71	75.66	30.16**	58.99**
Calcium (mg)	600	321.54 ± 48.14	53.59	40.91**	328.46 ± 55.03	54.74	34.68**	361.23 ± 60.18	60.21	28.05**	7.52**
Iron (mg)	21	13.39 ± 2.25	63.76	23.93**	14.44 ± 2.54	68.78	18.26**	17.33 ± 2.56	82.50	10.13**	34.45**
β-carotene (mcg)	4800	1353.72 ± 205.41	28.20	-118.86**	1473.70 ± 176.48	30.70	-133.27**	2872.58 ± 270.24	59.85	50.43**	730.73**
Vitamin C (mg)	40	20.67 ± 3.18	51.66	42.97**	22.27 ± 2.63	55.68	47.71**	26.94 ± 2.96	67.35	32.22**	61.83**

CP – Classic PCOS, NP – Normandrogenic PCOS, CN – Control, ** - significant at 1%, * - significant at 5%
- RDA for Indians, NIN (ICMR), NS – non-significant

Conclusion

Poor eating habits were demonstrated in this group of PCOS women and this may contribute to the development of long-term health risks later in life including infertility. This necessitates designing and conductingnutrition interventions focusing onappropriate food habits to control symptoms and complications of PCOS that can help in improving the reproductive health of women with PCOS.

Declaration

The authors declare no conflict of interest.

References

1. Azziz R, Marin C, Hoq L, Badamgarav E, Song P. Health care-related economic burden of the polycystic ovary syndrome during the reproductive life span. The Journal of Clinical Endocrinology & Metabolism 2005;90(8):4650-4658.
2. Bazarganipour F, Ziaei S, Montazeri A, Foroozanfard F, Kazemnejad A, Faghihzadeh S. Body image satisfaction and self-esteem status among the patients with polycystic ovary syndrome. Iranian journal of reproductive medicine 2013;11(10):829.

3. Cassel J. Social and cultural implications of food and food habits. American Journal of Public Health and the Nations Health 1957;47(6):732-740.
4. Chavarro JE, Rich-Edwards JW, Rosner BA, Willett WC. Diet and lifestyle in the prevention of ovulatory disorder infertility. Obstetrics &Gynecology 2007;110(5):1050-1058.
5. Colombo O, Pinelli G, Comelli M, Marchetti P, Sieri S, Brighenti F *et al*. Dietary intakes in infertile women a pilot study. Nutrition Journal 2009;8(1):1-9.
6. Douglas CC, Norris LE, Oster RA, Darnell BE, Azziz R, Gower BA. Difference in dietary intake between women with polycystic ovary syndrome and healthy controls. Fertility and sterility 2006;86(2):411-417.
7. Eleftheriadou M, Stefanidis K, Lykeridou K, Iliadis I, Michala L. Dietary habits in adolescent girls with polycystic ovarian syndrome. Gynecological Endocrinology 2015;31(4):269-271.
8. Fauser BC, Tarlatzis BC, Rebar RW, Legro RS, Balen AH, Lobo R *et al*. Consensus on women's health aspects of polycystic ovary syndrome (PCOS): the Amsterdam ESHRE/ASRM-Sponsored 3rd PCOS Consensus Workshop Group. Fertility and sterility 2012;97(1):28-38.
9. Ferriman D, Gallwey JD. Clinical assessment of body hair growth in women. The Journal of Clinical Endocrinology & Metabolism 1961;21(11):1440-1447.
10. Fauser B. Revised 2003 consensus on diagnostic criteria and long-term health risks related to polycystic ovary syndrome. Fertility and Sterility 2004;81(1):19-25.
11. Goodarzi MO, Dumesic DA, Chazenbalk G, Azziz R. Polycystic ovary syndrome: etiology, pathogenesis and diagnosis. Nature reviews endocrinology 2011;7(4):219-231.
12. Huijgen NA, Louwers YV, Willemsen SP, de Vries JH, Steegers-Theunissen RP, Laven JS. Dietary patterns and the phenotype of polycystic ovary syndrome: the chance of ongoing pregnancy. Reproductive biomedicine online 2017;34(6):668-676.
13. ICMR. Recommended Dietary intake of Indians. Hyderabad: National Institute of Nutrition (ICMR) 2010.
14. Kumarapeli V, Seneviratne RDA, Wijeyaratne CN, Yapa RMSC, Dodampahala SH. A simple screening approach for assessing community prevalence and phenotype of polycystic ovary syndrome in a semiurban population in Sri Lanka. American journal of epidemiology 2008;168(3):321-328.
15. Longvah T, Anantan I, Bhaskarachary K, Venkaiah K, Longvah T. Indian food composition tables. Hyderabad: National Institute of Nutrition, Indian Council of Medical Research 2017,2-58p.
16. Malik S, Jain K, Talwar P, Prasad S, Dhorepatil B, Devi G *et al*. Management of polycystic ovary syndrome in India. Fertility Science and Research 2014;1(1):23.
17. Misir A, Banjari I, Lončar I. Polycystic ovary syndrome (PCOS) – Pilot study on diet quality. *Hrana u zdravljuibolesti: znanstveno-stručničasopiszanutricionizamidijetetiku* 2016;5(1):15-19.
18. Moran LJ, Hutchison SK, Norman RJ, Teede HJ. Lifestyle changes in women with polycystic ovary syndrome. Cochrane Database of Systematic Reviews 2011,7.
19. Moran LJ, Ranasinha S, Zoungas S, McNaughton SA, Brown WJ, Teede HJ. The contribution of diet, physical activity and sedentary behaviour to body mass index in women with and without polycystic ovary syndrome. Human reproduction 2013;28(8):2276-2283.
20. Preetha N, Ramaswamy l. The Relationship between the Symptoms of Polycystic Ovarian Syndrome and Dietary Pattern of Selected College Going Girls 2013;4(1):2013–2015.
21. Rajashekar L, Krishna D, Patil M. Polycystic ovaries and infertility: our experience. Journal of human reproductive sciences 2008;1(2):65.
22. Shishehgar F, Tehrani FR, Mirmiran P, Hajian S, Baghestani AR, Moslehi N. Comparison of dietary intake between polycystic ovary syndrome women and controls. Global journal of health science 2016;8(9):302.
23. White D, Leigh A, Wilson C, Donaldson A, Franks S. Gonadotrophin and gonadal steroid response to a single dose of a long-acting agonist of gonadotrophin-releasing hormone in ovulatory and anovulatory women with polycystic ovary syndrome. Clinical Endocrinology 1995;42(5):475-481.
24. Wright CE, Zborowski JV, Talbott EO, McHugh-Pemu K, Youk A. Dietary intake, physical activity, and obesity in women with polycystic ovary syndrome. International journal of obesity 2004;28(8):1026-1032.