

DIETARY INTAKES IN INFERTILE WOMEN: PSYCHOLOGICAL CORRELATES

O.Colombo, M.D.^a, G.Pinelli, Ph.D.^a, M.Comelli, A.P.^a, S. Sieri, R.S.^b, F.Brighenti, F.P.^c,
R.E.Nappi, M.D., Ph.D.^d, A.Tagliabue, A.P.^a

^aDepartment of Applied Health Sciences, University of Pavia, via Bassi 21, 27100 Pavia,
Italy.

^bNutritional Epidemiology Unit, National Cancer Institute, Via Venezian 1, 20133 Milan,
Italy.

^cDepartment of Public Health, University of Parma, via Volturno 39, 43100 Parma, Italy.

^dResearch Centre for Reproductive Medicine – Dept of Morphological, Eidological and
Clinical Sciences & Gynecological Endocrinology Unit - Dept of Internal Medicine &
Endocrinology, IRCCS S. Maugeri Foundation, University of Pavia, Via Ferrata 8 - 27100
Pavia – Italy

e-mail addresses:

ottavia.colombo@unipv.it, giovanna.pinelli@unipv.it, mario.comelli@unipv.it,
sieri@istitutotumori.mi.it, furio.brighenti@unipr.it, renappi@tin.it, anna.tagliabue@unipv.it

Corresponding author:

Dr. Ottavia Colombo, M.D.

Department of Applied Health Sciences - University of Pavia

Via A.Bassi 21, I-27100 Pavia, Italy

tel. & fax: +39 0382 987869

e-mail: ottavia.colombo@unipv.it

ABSTRACT

Background

The reproductive axis is closely linked to nutritional status. The purpose of this study was to compare the nutritional status in two groups of young infertile women, without clinically overt eating disorders: hypothalamic amenorrhea (HA) vs. polycystic ovary syndrome (PCOS). Besides we aimed to verify the hypothesis that psychological distress can influence the accuracy of dietary surveys.

Methods

Eighteen young infertile women (10 HA, 8 PCOS) attending an outpatient gynecological endocrinology unit, underwent evaluation of anthropometry, body composition, dietary intakes by means of a food frequency questionnaire (FFQ) and a seven-day food diary (7DD), and psychological characteristics by means of EDI2 and SCL90 tests.

Results

HA women had lower BMI and body fat compared to PCOS women. Habitual energy intake derived from FFQs averaged 37 kcal/kg in both groups, with a similar macronutrient distribution (about 16% protein, 33% fat, 52% carbohydrates). The psychometric profiles of the two groups did not differ significantly. The underreporting of dietary intakes (measured as habitual energy intake by FFQs / basal metabolic rate) was found to be negatively correlated with the interpersonal sensitivity SCL-90 subscale scores ($r = -0.54$, $p=0.02$).

Conclusions

Our study identified differences in body composition but not in dietary habits between HA and PCOS infertile women. We documented, for the first time, a relationship between the accuracy of dietary surveys and the psychological characteristics of subjects with anovulation. This finding suggests that it may be important to be aware of the psychological terrain when planning a dietary survey in infertile women.

KEY WORDS: infertility, body composition, dietary intakes, underreporting, psychological correlates

BACKGROUND

Adequate nutritional status is a critical determinant of the onset and maintenance of normal reproductive function [1]. In 1974, Frisch and McArthur already wrote that weight loss causes loss of menstrual function (amenorrhea) and weight gain restores menstrual cycles [2]. They reported the occurrence of secondary amenorrhea in dieting women with weight loss in the range of 10-15% of normal weight for height, which is equivalent to a loss of about one third of body fat [3]. Nevertheless further studies showed that energy balance is more important than body fat mass itself for ovulatory function, since in some cases recovery may occur after minimal reacquisition of weight, or even long before there is any change in body weight or an increase in body fat [4].

Although amenorrhea is a diagnostic criterion of typical anorexia nervosa, nevertheless it may also be observed in young dieting women who do not meet full diagnostic criteria for an eating disorder or altered body composition [5]. In the latter study, the subjects' diets were typified by chronic intermittent restriction of energy intake, primarily through the avoidance of dietary fat. Indeed, a combination of mild energy deprivation, induced by nutritional or caloric restriction or exercise, and psychosocial distress, such as performance pressure, unrealistic goals and negative attribution consequent to depressive mood, personality characteristics and difficulties in coping with daily stress, are often documented in women with hypothalamic amenorrhea (HA) [6]. Besides, menstrual irregularities and infertility may also be observed in polycystic ovary syndrome (PCOS), even in the presence of stable or increased body weight [7]. In these cases the return of reproductive function occurs with modest weight loss (<10% of initial body weight) even though the end of study BMI often is over 30 kg/m² [8, 9].

Recently, several studies analysed dietary habits in women affected by PCOS [10-13], nevertheless, to our knowledge, since now no data are available on a comparison between

PCOS and other forms of anovulation. Therefore, the purpose of our study was to assess the nutritional status in young infertile women without clinically overt eating disorders, comparing dietary habits and body composition in two different type of infertility: PCOS vs. hypothalamic amenorrhea.

In addition, given the evidence that loss of menstrual function can represent a notable psychological distress for infertile women with PCOS [14-17], we also aimed to make a psychological assessment of the patients, in order to highlight any differences between the two groups and to verify the hypothesis that psychological distress can influence the accuracy of dietary surveys, affecting the capability to assess dietary habits by standard methods.

MATERIALS AND METHODS

Subjects

Outpatients attending a gynecological endocrinology unit were enrolled in the present study, after they have given informed consent. They were selected according to the following criteria: age 18-35 years; menstrual dysfunction and infertility; stable weight in the past three months. The exclusion criteria were: hyperprolactinemia; thyroid pathologies or other endocrine disorders; clinically overt eating disorders, past or present use of psychoactive agents. The study sample recruited comprised 18 young women with anovulation: 10 met the diagnostic criteria for functional hypothalamic amenorrhea (group A) [18] and 8 for polycystic ovary syndrome (group B) [19]. All the subjects gave their informed consent to participate in the study as described below. The study was approved by the ethics committee of the University of Pavia.

Procedure

Each patient underwent a complete medical history and a psycho-physical assessment, including psychometric tests, anthropometry and body composition analysis, evaluated by dual-energy x-ray absorptiometry (DXA). The subjects were instructed not to change their usual eating habits throughout the duration of the study and dietary intakes were assessed on the basis of the data collected using two instruments: a self-administered food frequency questionnaire (FFQ) and a seven-day food diary (7DD). In addition, a trained dietician assessed the glycemic index and glycemic load of each patient's diet, using a computerized system.

Anthropometry

Body height was measured to the nearest 0.5 cm using a wall-mounted stadiometer and weight (in light underwear) to the nearest 0.1 kg using a balance beam scale. Body mass index (BMI) was calculated in the standard way: weight in kg divided by height in m². With

the patients standing, their waist circumference was measured to the nearest 1 mm with a measuring tape placed at the midpoint between the lower border of the ribs and the upper border of the pelvis.

Body composition

Body fat was assessed by DXA using a Norland RX-26 scanner (Norland Corp., W, USA).

Seven-day food diary

Participants were asked to take home and complete the 7DD in the standard way [20]. The diary contains instructions and pages for recording foods eaten at six meals (breakfast, mid-morning snack, lunch, afternoon snack, dinner, after-dinner snack) on each of the seven days of the week. It is clearly explained in the instructions that respondents should record both the brands of food eaten and the size of the portions consumed each day.

Energy and nutrient intake analysis was carried out using a computerized system (Dieta ragionata 7.0 - ESI informatica, San Donato Milanese – Milan, 1997) developed using published Italian food composition tables [21,22].

Food frequency questionnaire

The FFQ, which is used to assess long-term food intake, was developed and validated [23] in the framework of the European Prospective Investigation into Cancer and Nutrition (the EPIC study). The instrument, which is designed to ascertain in detail how much and what kinds of food were consumed during the previous year, contains 254 questions about 188 different food items; it gives illustrations of three sample sizes of dish or references to standard portion sizes. The food categories investigated are cereals, vegetables, fruit, meat, fish, dairy products, sweet foods, alcoholic and non alcoholic beverages. Questions on seasoning and food preparation are also included.

Participants could specify the frequency of consumption of items by day, week, month or year. The average daily nutrient intake was calculated by multiplying the frequency of

consumption of each food portion by its nutrient content, as set out in the Italian food composition tables [22]. The FFQ was self-administered; the completed questionnaire was reviewed by a trained member of staff together with the participant to fill in any missing items.

Glycemic index and glycemic load

Pre-coded forms were used to investigate consumption of carbohydrate-rich foods, such as bread, sweet foods and carrots, and establish the glycemic index and the glycemic load of the patient's diet. The Department of Public Health of the University of Parma created the computerized system used in this part of the investigation and also evaluated the results.

Validity of dietary assessment methods

The ratio of reported energy intake to basal metabolic rate (BMR) calculated according to Schofield [24] (validity index) was used to measure the degree of underreporting. Individuals whose reported energy intake was less than 1.2 times their BMR were defined Low Energy Reporters (LERs) [25]. This cutoff was chosen on the basis of WHO/FAO estimations of the lowest plausible energy intakes at weight maintenance [26].

Psychometric tests

Each subject filled in the following questionnaires: the Eating Disorder Inventory (EDI2) and the Symptom Check List-90 (SCL-90). The SCL-90 is a 90-item tool designed to identify psychological distress. For each item, patients are required to rate how distressing they found the given problem during the previous week, on a scale of 0 (not at all) to 4 (extremely). The items are divided into nine domains (somatization, obsessive-compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism); there is also a global severity index (GSI), which is used as an indicator of overall psychological distress [27]. The EDI2 is a 91-item questionnaire with 11 subscales designed to quantify behavioral and cognitive features of anorexia nervosa and bulimia (drive

for thinness, bulimia, body dissatisfaction, ineffectiveness, perfectionism, interpersonal distrust, interoceptive awareness, maturity fears, ascetism, impulse regulation, social insecurity) [28]. For the analysis of the data, we referred to the Italian adaptation of the questionnaire, which contains data for the Italian population [29].

Statistical analysis

Descriptive statistics were preliminary calculated for all the variables divided into two groups according to the gynecological diagnosis. Analysis of variance (ANOVA) was used to assess between-groups differences for anthropometric parameters, dietary intakes and psychological scores. Differences between the psychometric scores of the study population and normative data from the literature were tested using the t test with the Welch correction for unequal variances. Correlations among the variables were examined using Pearson product-moment correlations. For descriptive purposes mean values \pm standard deviations are reported. A level of $p < 0.05$ was accepted as statistically significant. All analyses were performed using the SPSS/PC software program (version 13.0, SPSS Inc, Chicago).

RESULTS

Anthropometric and metabolic characteristics of the subjects

Table 1 shows the anthropometric and metabolic characteristics of the study population. The 18 infertile women had a mean age of 24 years (range 18-33 years). The patients in group A (HA) were slightly older and had significantly lower body weight, BMI, waist circumference, body fat mass and body fat percentage, and BMR than the women in group B (PCOS) ($p < 0.05$).

Psychometric assessment

The psychometric profiles of the two groups are illustrated in Figure 1.

No significant difference emerged between Group A and Group B either in total EDI2 scores (group A: 47.1 ± 21.3 vs. group B: 53.1 ± 24.1 , $p = 0.6$) or in any of the EDI2 subscale scores.

The mean values were comparable with normative data from age-matched healthy women [29], except for some subscales, on which infertile women recorded scores lower than control values: interoceptive awareness, ascetism and impulse regulation in group A (2.4 ± 2.1 vs. 5.2 ± 4.8 , $p < 0.005$; 2.8 ± 2.4 vs. 5.1 ± 3.3 , $p = 0.02$; and 1.7 ± 1.5 vs. 5.2 ± 5.1 , $p < 0.001$, respectively), and ascetism and social insecurity in group B (2.7 ± 2.0 vs. 5.1 ± 3.3 , $p = 0.02$, and 2.6 ± 1.7 vs. 4.5 ± 3.6 , $p = 0.02$, respectively). Moreover, although the mean values were comparable with normative data from age-matched healthy women, 6 of the 18 subjects (3 in group A) gave high scores on the drive for thinness subscale, and 4 of the 18 (2 in group A) gave high scores on the body dissatisfaction subscale.

With regard to the SCL-90, no significant differences were found between the groups either in the GSI (group A: 0.56 ± 0.42 vs. group B: 0.49 ± 0.32 , $p = 0.58$) or in any of the subscale scores. Furthermore, all the results were comparable with normative data from age-matched healthy women [15] except for the phobic anxiety subscale, on which women affected by PCOS recorded scores lower than control values (0.09 ± 0.15 vs. 0.28 ± 0.40 , $p = 0.02$).

Dietary intakes

The energy intakes calculated from the data collected using each of the two tools were not correlated with each other ($r = 0.321$, $p = 0.2$) and values derived from the 7DDs were significantly lower than those derived from the FFQs (Table 2). Considering data reported in the 7DDs, no difference emerged between the two groups as regards the mean calculated energy intake/BMR ratio (group A 1.10 ± 0.36 , group B 1.04 ± 0.29 , $p=0.73$). Overall, 12 women (67%) reported energy intakes less than 1.2 times their BMR and were thus classified as LERs (6 in group A and 6 in group B). Also considering data reported in the FFQs, no difference emerged between the two groups as regards the mean calculated energy intake/BMR ratio (group A 1.58 ± 0.44 , group B 1.67 ± 0.46 , $p=0.67$). Overall, 3 women (17%) reported energy intakes less than 1.2 times their BMR with this method and were thus classified as LERs (2 in group A and 1 in group B).

The results obtained from the 7DDs were excluded from the subsequent analyses due to the high percentage of LERs observed.

The habitual intake of energy and macronutrients, calculated from the FFQs, is shown in Table 3. Absolute values of energy and of total protein, carbohydrate and lipid intakes did not differ significantly between group A and group B, neither in absolute values nor when expressed per kg of body weight. Fat from animal origin and saturated fat intakes were significantly lower in group A than in group B ($p<0.05$). The glycemic load and glycemic index did not differ significantly between the two groups.

The habitual intake of energy and micronutrients, calculated from the FFQs, is shown in Table 4. Women affected by hypothalamic amenorrhea reported a significantly lower intake of sodium and thiamine than women affected by PCOS ($p<0.05$). Other micronutrients intakes did not differ significantly between the two groups.

The validity index (reported energy intake/BMR ratio) derived from the FFQs showed no correlation with anthropometric variables, but some correlations were found with psychometric variables. If we consider the entire group of infertile women taken together, the validity index was found to be negatively correlated with the interpersonal sensitivity ($r = -0.54$, $p = 0.02$) SCL-90 subscale scores. Considering the HA group alone, the validity index was found to be negatively correlated with the interpersonal sensitivity ($r = -0.66$, $p = 0.038$) and somatization ($r = -0.68$, $p = 0.032$) SCL-90 subscale scores. No correlations were found in the PCOS group alone.

DISCUSSION

The present study investigated the nutritional status and dietary habits of infertile women, comparing values from women affected by hypothalamic amenorrhea to those of PCOS women.

As expected, women with functional HA were found to have lower BMI and body fat mass than women with PCOS. Besides, PCOS women showed a lower BMI compared to those recruited by Carmina and colleagues in the Italian setting of their study (24.3 ± 3.5 vs. 26.98 ± 0.3 , respectively) [13]. Hence, in agreement with previous reports [1,30], our data confirm that anovulation may be observed in women showing different body weight and adiposity.

As regards dietary habits, our study revealed an adequate energy intake. The macronutrient distribution found falls within macronutrient distribution ranges recommended for the healthy population [31]; these data are similar to those collected by Douglas and colleagues in a USA sample of PCOS women [10]. In the same way, our sample of PCOS women recorded a similar intake of polyunsaturated fat compared to the PCOS American sample (12.0 ± 3.6 vs. 12.5 ± 3.8 g/die, respectively), while they introduced higher amounts of saturated and monounsaturated fat and cholesterol compared to them (30.8 ± 8.9 vs. 24.3 ± 10.7 g/die, 43.6 ± 10.7 vs. 26.7 ± 10.1 g/die, 347.5 ± 108.7 vs. 245.6 ± 113.2 mg/die, respectively).

Comparing the two groups in our sample (HA vs. PCOS), a significant difference emerged in the intake of fat from animal origin and of saturated fat: women with hypothalamic amenorrhea introduced lower amounts than women with PCOS (32.0 ± 18.4 vs. 49.3 ± 15.5 g/die, and 21.4 ± 9.9 vs. 30.8 ± 8.9 g/die, respectively). The amount and quality of carbohydrate in diet may be important determinants of ovulation and fertility in healthy women, as suggested by Chavarro and colleagues [11], therefore we included in our study the evaluation of glycemic index and glycemic load, which did not show any significant difference between the two groups.

The limitations of dietary diary as a means of collecting data on nutrient intake must be recognized. The most notable weakness is that, despite appropriate training to the patients, usual dietary intakes may not be accurately reported in diaries, because subjects may make different food choices or underreport their actual food intake when using these instruments [20]. To allow for this possibility, a ratio of 1.2 between estimated energy intake and BMR has been suggested in previous studies [26]. In our population, an excessively high percentage of LERs was found with the 7DD method of data collection (60% in group A and 75% in group B, respectively), leading to the exclusion of 7DD-derived data from the subsequent analyses. On the contrary, the percentage of LERs observed with the FFQ was lower than that reported in one other study comparing 7DD and FFQ [32] and the mean ratio of reported energy intake to BMR, about 1.6, is compatible with an active lifestyle and a stable weight, as observed in our population of young women. The 7DD was found to be superior to the FFQ when assessed in comparison with weighed records and biomarkers [33], but it demands more time and attention because it has to be filled in after every meal or snack, and is therefore less readily accepted by some patients. This is the reason why also several other studies developed different methods, other than dietary diary, to assess dietary intakes [10-13].

As previously stated, another purpose of our work was to examine the two groups of infertile women also from the psychological point of view, in order to highlight any differences at basal assessment and to verify the hypothesis that psychological distress can influence the accuracy of dietary surveys, affecting the capability to assess dietary habits by standard methods. Dietary intakes and reporting are indeed influenced by psychological correlates and life events, but these parameters are not usually included in dietary surveys. In this work we studied psychological profiles by means of two validated psychometric tests and observed

some significant relationships between subscale scores and dietary intakes measured using the FFQ.

The significant negative correlation between the energy intake/BMR ratio and the interpersonal sensitivity subscale of SCL90 was particularly interesting and, to our knowledge, has never been reported in previous studies. This subscale focuses on feelings of personal inadequacy and inferiority, particularly in comparison to other individuals. Self-deprecation, feelings of uneasiness, and marked discomfort during interpersonal interactions are characteristic manifestations of this psychological dimension, as are acute self-consciousness and negative expectancies regarding interpersonal communications.

Underreporting is usually due to subjects modifying their food choices or underreporting their actual food intake. The above-mentioned negative correlation emerging in our study indicates that people who are more prone to feelings of personal inadequacy and inferiority will show an increased tendency to underreport, which leads to a lower ratio between reported energy intake and BMR (validity index).

The results of the psychometric tests suggest that a proportion (one third) of our sample of infertile women is weight-preoccupied. This characteristic is described in the literature [34] and highlights the need to screen for pathological eating behaviors in this population. Indeed, previous findings by our group indicated a high incidence of eating disorders, mainly anorexia and binge eating, in functional hypothalamic amenorrhea and polycystic ovary, respectively [35], with a significant correlation emerging between abnormal eating pattern of the bulimic type and reproductive function [36]. Besides, since loss of menstrual function can represent a notable psychological distress for women, a basal psychological assessment deserves particular attention when treating infertile patients.

CONCLUSION

Our study identified differences in body composition but not in dietary habits (except for animal and saturated fat, and some micronutrients) between infertile women affected by hypothalamic amenorrhea and PCOS women. In addition, we documented a relationship between the degree of underreporting and the psychological characteristics of the studied subjects, in particular by the interpersonal sensitivity subscale.

This finding, to be confirmed by a larger study sample, suggests that it may be important to be aware of the psychological characteristics when planning a dietary survey in infertile women.

COMPETING INTERESTS

The authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

O.C.: conception and design of the study; acquisition, analysis and interpretation of data; drafting of the manuscript; approval of the final version of the manuscript

G.P.: conception and design of the study; acquisition, analysis and interpretation of data; drafting of the manuscript; approval of the final version of the manuscript

M.C.: statistical analysis and interpretation of data; approval of the final version of the manuscript

S.S.: analysis of dietary intakes and interpretation of data; approval of the final version of the manuscript

F.B.: analysis of dietary intakes and interpretation of data; approval of the final version of the manuscript

R.E.N.: conception and design of the study; recruitment of patients; interpretation of data; approval of the final version of the manuscript

A.T.: conception and design of the study; acquisition, analysis and interpretation of data; drafting of the manuscript; approval of the final version of the manuscript

All the authors have read and approved the final manuscript.

ACKNOWLEDGEMENTS:

This research was supported by the Italian Ministry of Universities.

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Figure 1: Psychometric profiles of infertile women with hypothalamic amenorrhea (group A) and polycystic ovary syndrome (group B).

Upper panel: EDI-2 subscales are indicated as follows: DT: drive for thinness, BU: bulimia, BD: body dissatisfaction, IN: ineffectiveness, P: perfectionism, ID: interpersonal distrust, IA: interoceptive awareness, MF: maturity fears, ASC: ascetism, IR: impulse regulation, SI: social insecurity.

Lower panel: SCL90 subscales are indicated as follows: SOM: somatization, O-C: obsessive-compulsive, INT: interpersonal sensitivity, DEP: depression, ANX: anxiety, HOS: hostility, PHOB: phobic anxiety, PAR: paranoid ideation, PSY: psychoticism, GSI: global severity index.

Table 1. Anthropometric and metabolic characteristics of the two groups of infertile women.

Variables	GROUP A ¹ n=10 (mean ± sd)	GROUP B ² n=8 (mean ± sd)
Age (years)	26.0 ± 4.4*	21.0 ± 3.2
Weight (kg)	54.1 ± 6.9*	67.2 ± 7.9
Height (m)	1.6 ± 0.0	1.7 ± 0.1
BMI (kg/m ²)	19.9 ± 2.3*	24.3 ± 3.5
WC(cm)	69.6 ± 4.5*	81.3 ± 6.8
Body fat (kg)	13.9 ± 5.8*	23.8 ± 8.8
Body fat (% weight)	25.3 ± 7.5*	35.2 ± 9.4
BMR (kcal/24 h)	1287.2 ± 96.4*	1483.4 ± 116.9

BMI= body mass index; WC = waist circumference; BMR=basal metabolic rate

¹ hypothalamic amenorrhea; ² polycystic ovary syndrome

* p< 0.05 between group A and group B

Table 2. Energy intakes calculated from 7-day diaries and food frequency questionnaires in the two groups of infertile women.

Variables	GROUP A ¹ n=10 (mean ± sd)	GROUP B ² n=8 (mean ± sd)
<i>7-day food diary</i>		
Energy (kcal/24 h)	1396.1 ± 435.1	1545.4 ± 432.9
Energy intake/BMR	1.10 ± 0.36	1.04 ± 0.29
LERs (% subjects)	60.0	75.0
<i>Food frequency questionnaire</i>		
Energy (kcal/24 h)	2010.1 ± 492.1*	2471.2 ± 676.1*
Energy intake/BMR	1.58 ± 0.44*	1.67 ± 0.46*
LERs (% subjects)	20.0	12.5

Energy intake/BMR: ratio of reported energy intake to basal metabolic rate; LERs = low energy reporters

¹ hypothalamic amenorrhea; ² polycystic ovary syndrome

* p<0.05, significant differences emerged between the mean energy intakes calculated from the two instruments (7-day food diary vs. food frequency questionnaire)

Table 3. Daily dietary intakes of macronutrients in infertile women, assessed using the food frequency questionnaire (FFQ).

Variables	GROUP A ¹ n=10 (mean ± sd)	GROUP B ² n=8 (mean ± sd)
Energy (kcal/24 h)	2010.1 ± 492.1	2471.2 ± 676.1
Energy intake/BMR	1.58 ± 0.44	1.67 ± 0.46
Energy (kcal/kg)	38.1 ± 11.9	37.1 ± 10.7
Total Protein (g)	82.9 ± 21.7	96.7 ± 19.4
Total Protein (% kcal)	16.7 ± 3.9	16.1 ± 2.3
Total Protein (g/kg)	1.6 ± 0.5	1.5 ± 0.3
Animal protein (g)	56.5 ± 19.4	66.7 ± 11.0
Vegetable protein (g)	26.4 ± 8.1	29.9 ± 11.3
Total Fat (g)	71.7 ± 26.1	91.7 ± 22.5
Total Fat (% kcal)	32.0 ± 9.1	33.8 ± 3.7
Total Fat (g/kg)	1.4 ± 0.6	1.4 ± 0.4
Animal fat (g)	32.0 ± 18.4	49.3 ± 15.5 *
Vegetable fat (g)	39.7 ± 17.5	42.4 ± 16.5
Saturated fat (g)	21.4 ± 9.9	30.8 ± 8.9 *
Monounsaturated fat (g)	34.9 ± 13.4	43.6 ± 10.7
Polyunsaturated fat (g)	11.0 ± 7.7	12.0 ± 3.6
Cholesterol (mg)	291.6 ± 115.1	347.5 ± 108.7
Total Carbohydrates (g)	256.6 ± 82.9	331.4 ± 116.6
Total Carbohydrates (%kcal)	50.6 ± 7.4	53.0 ± 5.0
Total Carbohydrates (g/kg)	4.9 ± 1.8	4.9 ± 1.6
Starch (g)	130.4 ± 61.1	168.2 ± 64.9
Soluble sugars (g)	125.7 ± 56.4	162.7 ± 63.2
Total Fiber (g)	24.3 ± 5.1	24.4 ± 8.1
Glycemic load (g)	107.4 ± 45.9	128.8 ± 57.0
Glycemic index	52.2 ± 2.7	54.5 ± 3.8
Water (ml)	1675.7 ± 690.0	1606.8 ± 698.5
Alcohol (g)	9.5 ± 15.7	1.6 ± 1.6

Energy intake/BMR: ratio of reported energy intake to basal metabolic rate

¹ hypothalamic amenorrhea; ² polycystic ovary syndrome

* p<0.05, mean values were significantly different between group A and group B

Table 4. Daily dietary intakes of micronutrients in infertile women, assessed using the food frequency questionnaire (FFQ).

Variables	GROUP A ¹ n=10 (mean ± sd)	GROUP B ² n=8 (mean ± sd)
Iron (mg)	13.3 ± 2.1	14.2 ± 3.4
Calcium (mg)	926.1 ± 475.1	1146.2 ± 497.4
Sodium (mg)	1821.7 ± 632.9	2927.8 ± 792.5 *
Potassium (mg)	3887.5 ± 765.7	3909.2 ± 958.5
Phosphorus (mg)	1385.9 ± 423.5	1572.3 ± 425.7
Zinc (mg)	10.7 ± 2.9	12.8 ± 2.5
Thiamin (mg)	1.1 ± 0.2	1.3 ± 0.3 *
Riboflavin (mg)	1.8 ± 0.5	2.1 ± 0.7
Niacin (mg)	19.7 ± 3.4	21.3 ± 5.1
Vit. C (mg)	189.4 ± 103.1	205.6 ± 91.1
Vit. B6 (mg)	2.1 ± 0.4	2.4 ± 0.4
Folic acid (µg)	319.9 ± 61.4	358.0 ± 124.5
Vit.A (REQ)	1266.1 ± 429.2	993.8 ± 411.0
Vit. E (mg)	12.1 ± 3.8	13.5 ± 5.5
Vit. D (µg)	3.7 ± 2.5	3.0 ± 0.9

¹ hypothalamic amenorrhea; ² polycystic ovary syndrome

* p<0.05, mean values were significantly different between group A and group B

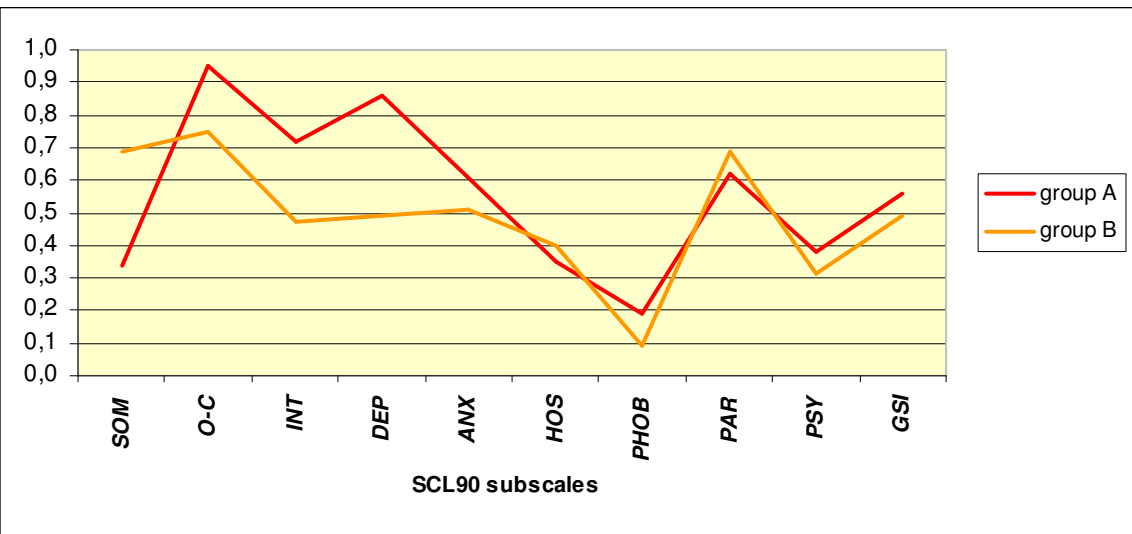
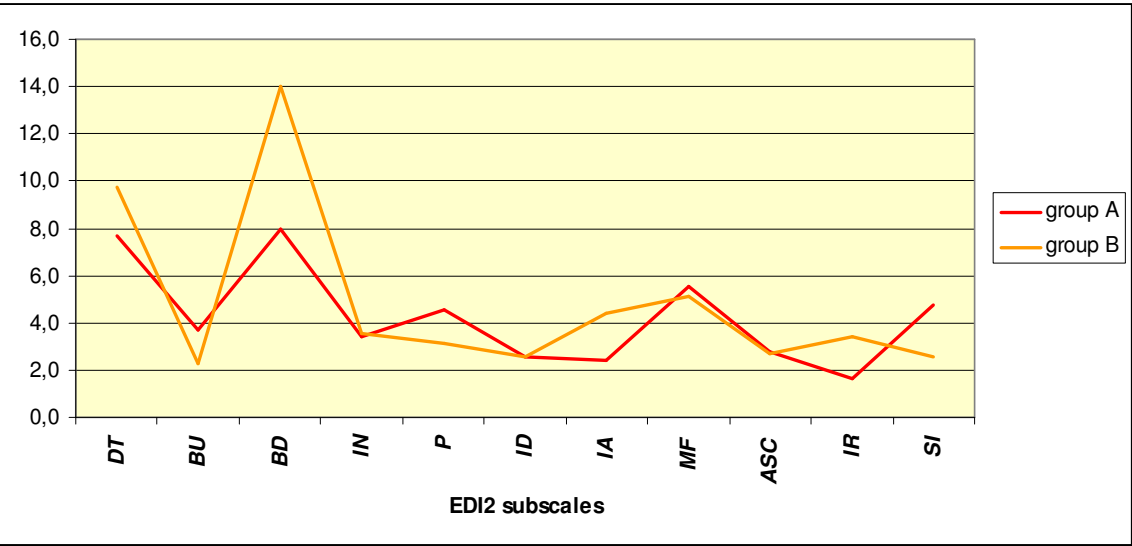


Figure 1