

Telephone Counseling Intervention Improves Dietary Habits and Metabolic Parameters of Patients with the Metabolic Syndrome: A Randomized Controlled Trial

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■ Abstract

BACKGROUND: Patients with the metabolic syndrome (MetS) can suffer from poor metabolic parameters through lack of adherence to requisite lifestyle changes in dietary and physical activity. Usually, interventions in MetS patients are infrequent face-to-face consultations. The low frequency or absence of counseling interviews leads to a shortage of information and motivation to adhere to the recommended lifestyle changes. Telephone interventions could be an additional low-cost tool for effective interventions. **AIM:** To evaluate the effectiveness of telephone intervention in improving lifestyle habits and metabolic parameters in MetS patients compared with similar face-to-face or a usual care interventions. **METHODS:** Eighty-seven MetS patients recruited from the outpatient clinic of a major public hospital were randomly assigned to one of the three intervention groups: "usual care", "telephone" or "face-to-face". At the beginning of the study, all patients were provided with a hypocaloric Mediterranean-type diet. Afterwards, patients in the telephone group received 7 dietary counseling calls, pa-

tients in the face-to-face group participated in 7 one-to-one dietary counseling sessions, while patients in the usual care group received no other contact until the end of the study, 6 months later. All patients underwent full medical and nutritional evaluation at the beginning and at the end of the intervention. **RESULTS:** At the end of the intervention, 42% of the participants no longer showed symptoms of MetS; the reduction rates differed significantly between the groups ($p = 0.024$), with those in the face-to-face and telephone group exhibiting similar rates (52% and 54%, respectively, vs. 21% in the usual care group). Between-group analysis revealed that the face-to-face group achieved the greatest improvement in metabolic parameters, while the telephone group had the greatest improvement in dietary adherence compared with the usual care group. **CONCLUSIONS:** Telephone counseling is an effective way to implement behavioral counseling to improve lifestyle habits in MetS patients.

Keywords: type 2 diabetes · metabolic syndrome · lifestyle intervention · Mediterranean diet · telephone counseling · diet score

Introduction

The prevalence of type 2 diabetes and cardiovascular disease is high in most western countries, and is expected to continue to rise over the next years [1-3]. The metabolic syndrome (MetS) has been proposed to substantially increase

the risk of developing both diseases [4-6]. Modifying dietary and physical activity habits through lifestyle interventions effectively improves MetS parameters [7-10]. Therefore, extensive lifestyle interventions are needed to change the prevalence of type 2 diabetes and the ensuing complications. Considering low-cost interventions, it is interest-

ing to find out whether intervention by telephone is as effective as other forms. In this regard, dietary counseling by telephone has already been used successfully to promote a balanced diet in healthy populations, and populations at risk for disease [11-13]. It has been found effective, efficient, and feasible in changing physical activity and dietary behaviors in adults [14-17]. In patients with type 2 diabetes or hypertension, telephone counseling effectively induced beneficial dietary changes, improvements in glycemic control, and modifications in antihypertensive medication regime [18-21].

In most of the studies performed so far, telephone counseling has only been compared with usual care [16], which typically means minimum intervention. However, there is limited evidence on the effectiveness of telephone counseling compared with an intensive lifestyle face-to-face intervention. Furthermore, an evaluation of telephone counseling for improvement of dietary and physical activity habits in MetS patients remains relatively unexplored. Given the high number of MetS patients with disadvantageous lifestyle pattern, an improvement is urgently needed. Therefore, the aim of the present study was to evaluate the efficacy of a lifestyle intervention program for improvement of the metabolic parameters in MetS patients through telephone intervention compared with other interventions implemented through face-to-face sessions.

Methods and patients

Participants and recruitment

The study participants were patients who underwent medical evaluation in the outpatient lipid clinic of a major public hospital in Athens, Greece. Patients were eligible to participate if they were diagnosed with MetS. MetS was diagnosed if three of the following criteria, according to the Adult

Abbreviations:

ANOVA - analysis of variance
BMI - body mass index
BP - blood pressure
D-LIMS Score - Dietary Lifestyle Intervention for the Metabolic Syndrome Score
FFQ - food frequency questionnaire
HAPAQ - Harokopio Physical Activity Questionnaire
HDL - high-density lipoprotein
MetS - metabolic syndrome
NCEP - National Cholesterol Education Program
SD - standard deviation
SPSS - statistical package for the social sciences

Treatment Panel III, were met [22]:

1. Waist circumference ≥ 102 cm in men or ≥ 88 cm in women.
2. HDL-cholesterol concentrations < 40 mg/dl in men or < 50 mg/dl in women.
3. Triacylglycerol concentrations ≥ 150 mg/dl.
4. Systolic blood pressure ≥ 130 mm Hg or diastolic blood pressure ≥ 85 mm Hg.
5. Fasting glucose concentration ≥ 100 mg/dl.

Exclusion criteria were:

- being on a diet during the previous year,
- being diagnosed with type 1 or type 2 diabetes, cardiovascular disease, or any other serious medical condition.

Also, patients were excluded if they were on medication having an impact on body weight, i.e. corticosteroids. A total of 110 patients met the above criteria; 21 could not participate due to family reasons or limited time schedule, leaving 87 patients eligible for randomization to the intervention groups (Figure 1). Patients participating in the study had the following conditions: 53% had hypertension and 62% hypercholesterolemia. Medications for these conditions were prescribed to medical standards. Specifically, statins were given for hypercholesterolemia and anti-hypertensive agents were given for hypertension. No changes in the medication were made throughout the study.

The study was approved by the Ethics Committee of Harokopio University and the Hospital Medical Research Ethics Committee. Participants were required to give written consent. The study procedures were in accordance with the World Medical Association Declaration of Helsinki, which describes the ethical principles for medical research involving human subjects.

Study design

The study was a single-blinded randomized controlled trial. Apart from the aim to improve their metabolic parameters, the patients were not informed about the purpose to compare the effectiveness of telephone counseling with that of face-to-face counseling and usual care, and the existence of other groups was concealed. One of the study investigators (EF) was responsible for enrollment, randomization, and assignment of participants to the interventions. At baseline, all patients underwent full medical and nutritional as-

assessment and were given a hypocaloric, Mediterranean-style diet, based on Adult Treatment Panel III guidelines and National Nutritional Guidelines [23-24]. These guidelines recommend the provision of 500 calories less than the individual energy need, estimated through two 24-hour dietary recalls. Also, participants were given verbal instructions on how to implement the required dietary changes, and how to increase their physical activity patterns.

Afterwards, patients were randomly assigned (using a random-number table) to one of the following three study groups:

1. "Face-to-face" counseling group (n = 29).
2. "Telephone" counseling group (n = 29).
3. "Usual care" group (n = 29).

All assessment and counseling sessions took place at the hospital outpatient clinic.

Face-to-face counseling group

Patients assigned to the face-to-face counseling group received nutrition counseling through seven one-hour, one-to-one sessions, conducted every two weeks for the first 2 months, and every month thereafter until the end of the 6-month evaluation period. Experienced clinical dietitians with appropriate training conducted the counseling sessions. The intervention was based on the goal setting theory [25]. Motivational and behavioral strategies were also used, namely exploration of readiness, ambivalence and self-efficacy, the use of self-monitoring, stimulus control and problem-solving techniques, management of high-risk situations, and relapse prevention training [26-27]. A visual agenda-setting chart was one of the tools employed during the intervention [28]. Patients were encouraged to identify their own priority goal, and to propose feasible changes in their lifestyle to reach the goal. At the beginning of each session, previous goals were re-evaluated. For every goal achieved, a new one was allocated so that, at the end of the meeting, 2-3 goals were established, one of them regarding physical activity. Positive reinforcement was provided throughout the intervention.

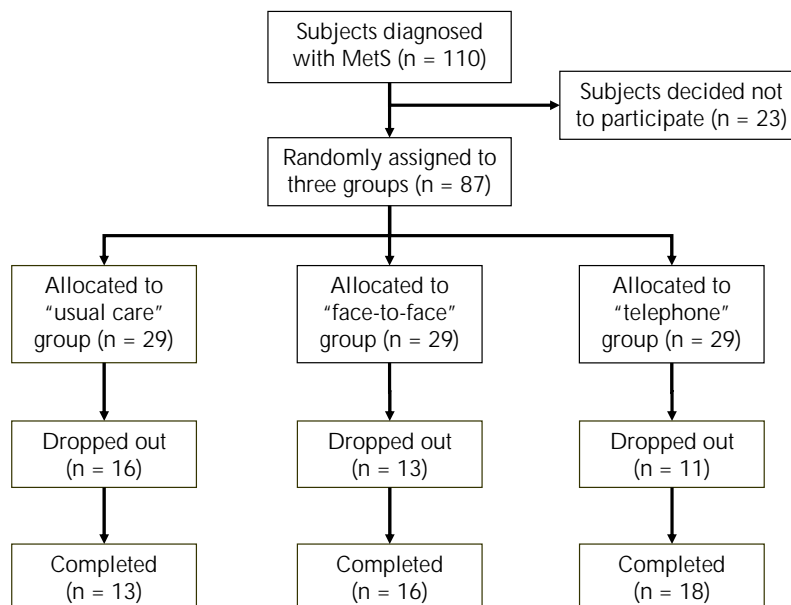


Figure 1. Flow of participants through the study.

The dietary and physical activity goals proposed by the National Cholesterol Education Program (NCEP) [24] were modified to conform with the Mediterranean dietary patterns, and targeted during the intervention. The following specific lifestyle behavior patterns were proposed for the accomplishment of each goal:

- Decreased portion size and increase of physical activity for the weight management.
- Increased intake of fruits, vegetables, legumes, whole grain cereals to achieve the dietary fiber goal.
- Decreased consumption of red meat and products, full fat dairy products, and sweets to decrease the intake of saturated fatty acids and cholesterol.
- If necessary, decreased intake of salt and salty foods to reach the sodium goal.

Telephone counseling group

Patients in the telephone counseling group received equal numbers of telephone sessions similar in content to the personal contacts provided in the face-to-face group. However, the duration of the counseling talks was shorter than in the face-to-

Table 1. The seven dietary components of the D-LIMS Score

Effect	Food group	Goal
Beneficial to health	Fruit	2-5 servings per day
	Vegetables	≥ 3 servings per day
	Whole grain products	≥ 3 servings per day
	Legumes	3-5 servings per week
	Fish	2-4 servings per week
Detrimental to health	Full fat dairy products	≤ 1 serving per day
	Red meat	≤ 4 servings per week

face group, lasting only 20 minutes on average. Calls were made during evening hours and via the home telephone numbers. If the patient could only be reached on cell phone, or if the calling time was inappropriate for discussion, a telephone call appointment was arranged.

Usual care group

Patients assigned to the usual care group received instructions regarding all dietary and physical activity goals only in the baseline session. No further lifestyle-related counseling and contact was provided until the end of 6-month study period. For ethical reasons, patients were permitted to contact the dietitian for more information or support if needed, but no requests were received from patients in this group.

Clinical, nutritional, and biochemical assessment

All patients were evaluated at baseline and after a 6-month period. Evaluation included anthropometric measurements and evaluation of the MetS parameters, dietary and physical activity assessment. Sociodemographic characteristics such as current work and family status educational level, and personal income were recorded by a self-administered questionnaire.

Anthropometric and clinical measurements

Weight and height were measured on a leveled platform scale and a wall-mounted stadiometer, to the nearest 0.5 kg and 0.5 cm. The body mass index (BMI) was calculated as weight in kg divided by height in m². Waist circumference was meas-

ured in the middle between the 12th rib and the iliac crest.

For the assessment of blood pressure, participants remained comfortably seated with their legs uncrossed for at least 5 minutes before blood pressure measurements. With the use of a sphygmomanometer, two measurements were taken ≥1 min apart and recorded to the nearest 2 mmHg. The two values were averaged for the final reading. Antihypertensive medication was also recorded.

Biochemical analysis

Blood samples were collected in the morning after a 12-h fast. Concentrations of plasma glucose, serum triglycerides, and HDL-cholesterol were determined using commercial kits (Abbot Laboratories, Abbott Park, IL, USA) on an automated analyzer (Aeroset, Abbot).

Dietary and physical activity assessment

Dietary intake was assessed by two consecutive 24-hour recalls and a food frequency questionnaire (FFQ). The 24-hour recall interview was based on the five-step multiple pass method [29]. The type of foods consumed (e.g. in terms of fat-content, brand name, constituents of mixed dishes, etc.), and the quantities or volumes were recorded in detail, using common household or other measures (rulers, pack of playing cards, computer mouse, etc). Data from recalls were analyzed for their energy, macro- and micronutrient content by the Nutritionist Pro, version 2.2 software (Axxya Systems-Nutritionist Pro, Stafford, TX, USA), using a hand-coding procedure. The Nutritionist Pro food database was expanded by adding analyses of traditional Greek food and recipes [30-31].

A semi-quantitative 80-item FFQ has been developed for the purposes of this study. The FFQ was based on a widely used semi-quantitative FFQ [32] to include the main food groups of the Greek diet and those targeted in the NCEP and Mediterranean diet guidelines. Briefly, on a daily, weekly, or monthly basis, the frequency of consumption of various food groups and beverages was recorded, including meat and meat products, fish and seafood, milk and other dairy, greens and salads, other vegetables, legumes, fruits, cereals (excluding pasta), pasta, potatoes, sweets, and beverages. The intake of various alcoholic beverages was quantified according to standard measures for

Table 2. Changes in MetS variables after the 6-month intervention for the three groups

Variable	Usual care group (n = 29)	Telephone group (n = 29)	Face-to face group (n = 29)	p
BMI (kg/m²)				
Baseline	30.5 ± 4.5	32.4 ± 4.7	32.5 ± 4.9	NS
Change at 6 mo	-0.1 ± 1.0	-1.4 ± 1.5 [§]	-1.2 ± 1.4 ^{†‡}	< 0.001
Waist (cm)				
Baseline	101.1 ± 9.2	106.4 ± 11.1	105.9 ± 9.1	NS
Change at 6 mo	-0.5 ± 4.4	-4.1 ± 5.0 [§]	-3.5 ± 4.4 [§]	< 0.001
Systolic BP (mmHg)				
Baseline	129.6 ± 15.8	124.5 ± 18.1	129.2 ± 14.8	NS
Change at 6 mo	3.0 ± 10.2	-3.9 ± 10.9 [§]	-7.1 ± 17.5 [§]	0.019
Diastolic BP (mmHg)				
Baseline	84.6 ± 13.6	83.9 ± 11.1	84.0 ± 9.3	NS
Change at 6 mo	0.8 ± 9.0	-6.5 ± 8.6 ^{†‡}	-6.3 ± 9.2 ^{†‡}	0.004
Serum HDL-chol. (mg/dl)				
Baseline	39.3 ± 9.2	41.5 ± 9.9	42.6 ± 10.0	NS
Change at 6 mo	3.0 ± 7.2 [†]	2.7 ± 7.1 [†]	3.5 ± 10.9	NS
Serum TG (mg/dl)				
Baseline	307.6 ± 227.9	270.6 ± 117.8	232.9 ± 144.3	NS
Change at 6 mo	-36.6 ± 81.5 [†]	-103.7 ± 93.7 ^{†‡}	-70.8 ± 119.3 [†]	0.008
Plasma glucose (mg/dl)				
Baseline	100.8 ± 14.5	101.7 ± 12.4	104.2 ± 10.9	NS
Change at 6 mo	0.8 ± 7.4	-1.6 ± 11.9	-5.6 ± 14.0 ^{†‡}	0.03

Legend: Data are mean ± SD. Change at 6 mo: 6-mo value minus baseline value. BP - blood pressure. TG - triglycerides. [†] p < 0.05 vs. baseline values for within-group differences. [‡] p ≤ 0.001 vs. baseline values for within-group differences. ^{†‡} p < 0.05 vs. "usual care" group for between-group differences. [§] p ≤ 0.001 vs. "usual care" group for between-group differences.

each beverage. Additionally, the type of fat used in cooking or salad and the consumption of visible fat on red meat or chicken skin was assessed. The Mediterranean Diet Score (with theoretical range of 0-55) was used for the overall assessment of eating habits, and the adherence to the Mediterranean Diet [33].

The physical activity was assessed by a brief self-reported questionnaire (the Harokopio Physical Activity Questionnaire - HAPAQ). The questionnaire collects the previous week's self-reported physical activity, and examines the time spent in light, moderate, and high intensity activities and in sleeping [34].

Evaluation of dietary adherence to the lifestyle intervention

The Dietary Lifestyle Intervention for the Metabolic Syndrome Score (D-LIMS Score) was

developed to evaluate the degree of overall adherence to the goals of the intervention. Each of the seven components of the scoring system corresponded to the goals of the intervention, with a score of either 1 or 0 for each item, according to whether the lifestyle goal was achieved or not. The goal for healthy eating behavior included the consumption of vegetables and whole grain cereals, and was scored as zero value if the consumption was lower than three portions per day, which equates to the lower limit of intake shown to decrease cardiovascular risk [35]. Unhealthy eating habits included the consumption of full fat milk products and red meat, and were assigned corresponding cut-off limits, as shown in Table 1. The D-LIMS scores ranged from zero (non-adherence to lifestyle goals) to 7 (full adherence to lifestyle goals).

Data analysis

Data are presented as mean ± standard deviation (SD) for the continuous variables, and as relative frequencies (%) for the categorical variables. Normality was evaluated using the Kolmogorov-Smirnoff test. For normally distributed variables, one way analysis of variance (ANOVA) was applied to test for differences between groups, and paired samples *t*-test for differences within groups following intervention. For non-normally distributed variables, the Kruskal-Wallis and the Wilcoxon test were used. Differences in characteristics presented as frequencies were evaluated by the chi-square test. All analyses followed the intent-to-treat principle, using all randomized participants, and assuming no change from baseline for those with missing data [36-37]. Research hypotheses were tested at the 0.05 significance level for the two-tailed test. The statistical software package

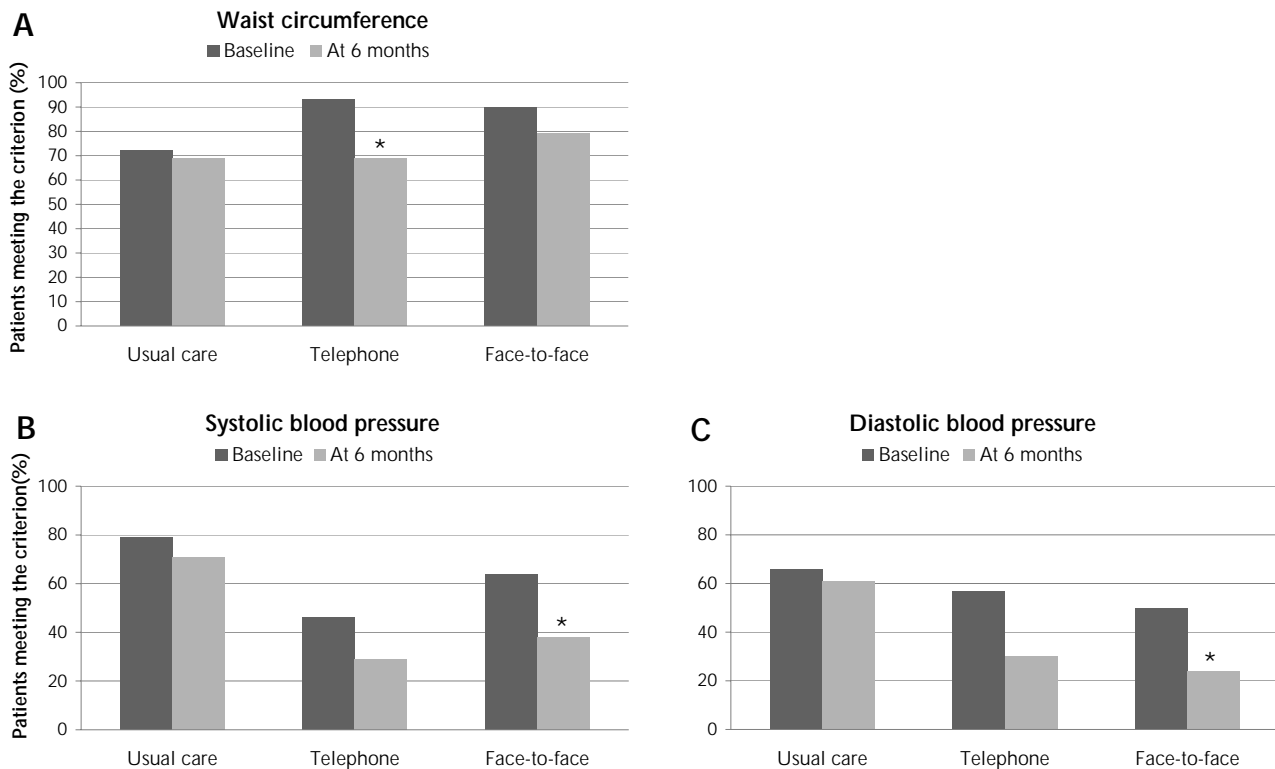


Figure 2. Interventional reduction of metabolic syndrome criteria related to obesity and hypertension. The diagrams show the percentages of participants meeting metabolic syndrome (NCEP-ATP-III) criteria for waist circumference (A), systolic blood pressure (B), and diastolic blood pressure (C) at baseline and after the 6-month intervention, by intervention group. * $p < 0.05$ vs. baseline values for within-group differences.

for social sciences, version 13.0 (SPSS Inc. 2003, Chicago, IL, USA) was used for all statistical calculations.

Results

At baseline, no statistically significant differences were observed between the three groups regarding sex, age, education level, and MetS parameters (Table 2). The mean age of the study population was 49.0 ± 11.8 years, 57% were men, and 56% had completed at least 12 years of education. The overall percentage of patients not attending the 6-month evaluation was 45% (face-to-face group: 45%, telephone group: 38%, usual care group: 52%; $p = 0.573$).

At the end of the intervention, improvements in various MetS parameters were found in all groups, compared with baseline values (Table 2). Patients in the face-to-face group achieved the greatest

change, as they significantly decreased five of the metabolic parameters. They were followed by the telephone group, who significantly improved three of the parameters. The usual care group showed improvement in only two parameters (Figures 2 and 3). Adjustment for baseline BMI and waist circumference did not change the results.

By the end of the 6-month period, a reduction was observed in the percentage of patients meeting the individual MetS criteria for all intervention groups. However, the results reached statistical significance only with respect to the decrease in waist (Figure 2A) and triglycerides (Figure 3B) in the telephone group, but with respect to a decrease in blood pressure (Figure 2B-C), glucose, and triglycerides (Figure 3) in the face-to-face group. Overall, 42% of the participants no longer showed criteria of MetS after intervention. Significant differences in MetS reduction rates were found between the three groups ($p = 0.024$) (Figure 3D).

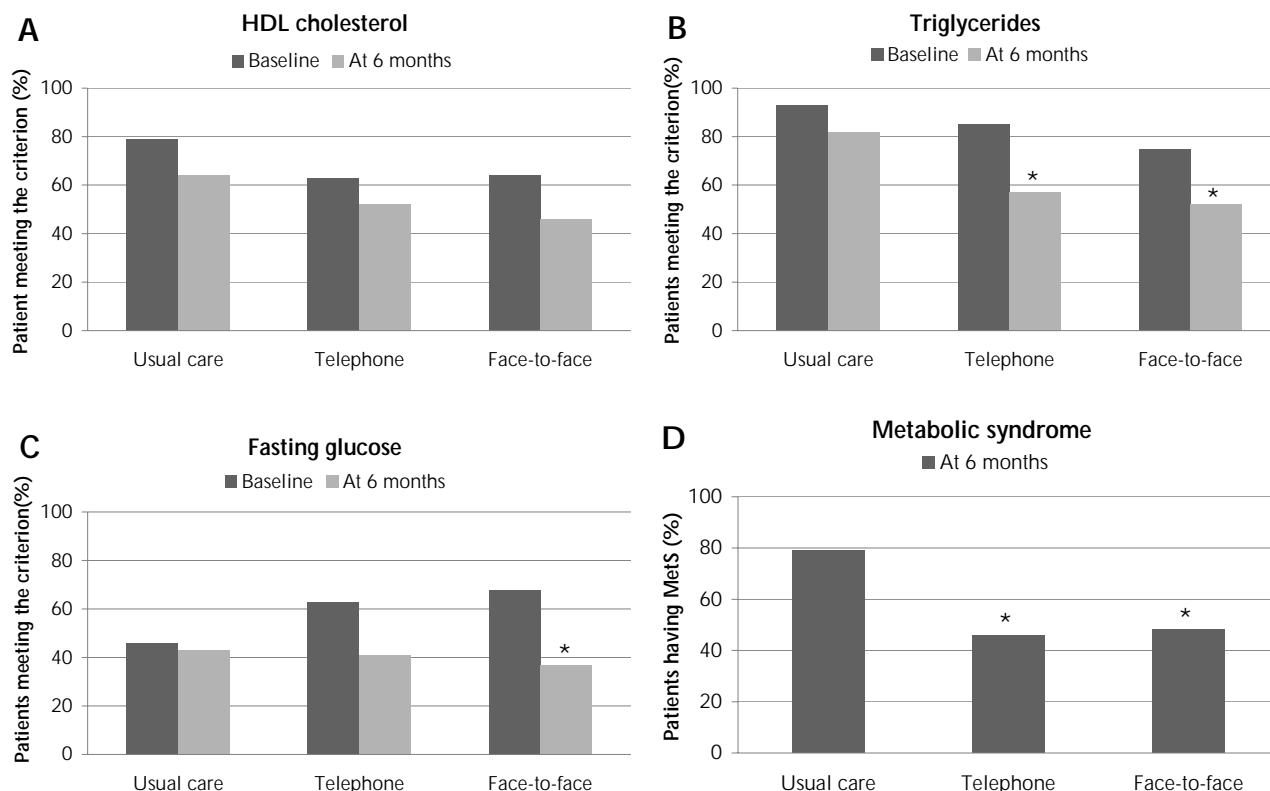


Figure 3. Interventional reduction of metabolic syndrome criteria related to lipids and glycemia. The diagrams show the percentages of participants meeting metabolic syndrome (NCEP-ATP-III) criteria for HDL cholesterol (A), triglycerides (B), and fasting glucose (C) at baseline and after the 6-month intervention, by intervention group. D: percentages of participants with the metabolic syndrome after the 6-mo intervention period. * $p < 0.05$ vs. baseline values for within-group differences.

Regarding the dietary assessment, changes in energy and macronutrient intake for each intervention group are presented in Table 3. Regarding food groups, at the end of the 6-month evaluation period, a significant difference between the groups was found only for fruit intake ($p = 0.042$). Whereas, in the overall assessment of dietary habits, the telephone group significantly increased the Mediterranean Diet Score at the end of the intervention period (Table 3). A significant difference was found for D-LIMS score changes during the intervention between the three groups ($p = 0.037$), with those in the telephone group achieving the greatest improvement. In particular, at the end of the intervention, a significant increase in the score was found for the telephone group compared to the usual care group ($p = 0.014$) (Table 3). Within-group or between-group differences regarding physical activity levels were not significant.

Discussion

The present study is the first randomized controlled trial to evaluate the effectiveness of telephone counseling to improve dietary and lifestyle patterns of MetS patients, and thus to improve their metabolic parameters. We found that this method of intervention was successful in improving dietary habits, body weight, and metabolic parameters in MetS patients. Furthermore, telephone counseling added to usual care induced greater reduction in BMI, and repressed the prevalence of MetS.

It has been proposed that weight reduction is the cornerstone of the management of MetS [38]. In the present study, a significant reduction in BMI was found for patients in the telephone group (4.3%) compared to those in the usual care group (no change). This reduction is among the highest

Table 3. Comparison of quality of life and patient-perceived difficulties between patients poorly controlled on 1-OHA therapy and patients better controlled on 2-OHA or insulin-based therapy

Energy	Usual care group			Telephone group			Face-to-face group			p [#]
	Baseline	6 mo	p	Baseline	6 mo	p	Baseline	6 mo	p	
Energy (kcal)	1952 ± 853	1944 ± 852	NS	2192 ± 935	1915 ± 759	0.037	2043 ± 766	1827 ± 615*	0.055	NS
Full fat dairy prod. (s/d)	1.8 ± 1.8	1.3 ± 1.8	0.016	2.0 ± 2.3	1.8 ± 2.2	NS	3.0 ± 3.5	2.4 ± 3.3	0.029	NS
Non-refined cereals (s/d)	2.1 ± 2.4	2.0 ± 2.2	NS	1.5 ± 2.0	1.7 ± 2.0	NS	2.0 ± 2.8	2.3 ± 2.9	NS	NS
Fruits (s/d)	3.2 ± 1.8	3.1 ± 1.7	NS	2.3 ± 1.9	2.6 ± 1.6*	NS	2.6 ± 2.1	2.4 ± 1.9	NS	0.042
Vegetables (s/d)	2.1 ± 1.3	2.3 ± 1.3	NS	2.8 ± 2.3	3.1 ± 1.6	NS	2.6 ± 2.2	2.7 ± 2.5	NS	NS
Red meat prod. (s/wk)	21.4 ± 28.5	21.0 ± 28.7	NS	17.4 ± 18.6	13.3 ± 11.1	0.035	11.4 ± 7.4	9.5 ± 7.5	0.039	NS
Legumes (s/d)	4.8 ± 6.4	5.5 ± 7.5	NS	4.2 ± 3.6	5.7 ± 6.8	NS	4.5 ± 3.7	4.9 ± 4.1	NS	NS
Fish (s/d)	5.5 ± 5.1	6.1 ± 5.5	NS	4.2 ± 3.9	6.7 ± 6.9	0.084	4.1 ± 3.8	4.9 ± 4.2	0.084	NS
D-LIMS Score (0-7)	2.7 ± 1.0	2.7 ± 1.0	NS	2.1 ± 1.6	2.8 ± 1.5*	0.02	2.2 ± 1.3	2.6 ± 1.5	NS	0.037
MedDietScore (0-55)	34.8 ± 4.6	35.1 ± 4.2	NS	32.1 ± 6.2	34.8 ± 5.1	0.01	33.9 ± 5.2	34.5 ± 6.2	NS	0.096

Legend: Data are mean ± SD. s/d - servings per day. NS - not significant. [#] p-values are for comparisons of between group changes. * p < 0.05 vs. "usual care" group for between-group differences.

achieved by telephone counseling in chronic disease patients. In the previous literature, telephone counseling produced the following outcomes:

- 1% body weight reduction in hypercholesterolemic patients after a 7-week lifestyle intervention [39].
- 1.2% BMI increase in type 2 diabetic patients after a 12-week intervention [20].
- 1.3% BMI decrease in coronary artery disease patients after a 4-month intervention [40].
- 1.8% BMI reduction in coronary heart patients after a 6-month intervention [41].

The greater effect observed in the present study could be attributed to the fact that the present study had a longer study period and/or included more telephone contacts than the other studies with intervention by telephone.

The greatest adherence to the lifestyle goals was observed in the telephone group, and this improvement could explain the weight reduction results. Evidence indicates that telephone lifestyle counseling provides an effective means for improving dietary and physical activity habits [16]. Telephone counseling has been shown to help patients decrease total fat, saturated fat, and dietary cholesterol consumption, and to increase fiber intake in patients with abnormal lipid profile after 1.5 to 6 months of intervention [39, 41]. Similar results were reported by Eakin *et al.* who found that pa-

tients with type 2 diabetes or hypertension decreased total and saturated fat intake both in 4 and 12 months of intervention and increased vegetable, fruit, and fiber intake after 12 months of intervention [18]. In the present study, patients in the telephone group decreased the consumption of red meat and meat products and increase fruit intake at the end of the 6-month intervention.

The improvement in dietary habits and body weight found in telephone group led to an improvement in four out of the six MetS parameters, followed by a 54% reduction in the prevalence of the syndrome in this group, compared to a 21% reduction achieved in the usual care group. Telephone counseling has been found to be more effective than usual care in improving various metabolic factors in chronic patients, namely lipid profile in patients with coronary heart disease or high blood cholesterol concentrations [39, 41] and glycemic control in type 2 diabetic patients [21, 42].

To date there has been insufficient data to determine the effectiveness of telephone counseling compared to face-to-face counseling. In the present study, patients in the telephone group achieved better dietary adherence, comparable weight loss, and MetS reduction rates, but milder improvements in MetS parameters when compared to the similar face-to-face treatment. Both interventions were similar with respect to the goals discussed and targeted. However, telephone communication could be more convenient for the patients, it be can

more flexibly fitted to the patients' everyday life, and promote a greater adherence to the beneficial lifestyle recommendations. Taking all into account, telephone counseling may be the method of choice in various settings and population groups as it is characterized by ease of implementation, cost-effectiveness, and the capacity to reach a large group of people [15, 43-44].

The major limitation of the present intervention trial was the high drop-out rate (45%). Few published reports have provided drop-out rates. The present drop-out rate was higher than in other telephone intervention studies that are also aimed at improving the patients' metabolic profiles (14-28%) [18, 21, 41]. However, there is evidence of higher drop-out rates (52%) in lifestyle interventions aimed at weight loss [45]. The high drop-out rate found here could be attributed to the fact that evening appointment was not available. This created difficulties for many patients who were requested to attend a morning meeting. The majority of patients were middle aged and still working. In-

terestingly, more patients in the telephone group completed the study than in the usual care and in the face-to-face group. This accords with previous evidence regarding adherence to telephone counseling [21] and confirms the advantages of this method of intervention. Another limitation was the absence of a long follow-up period. Long-term dietary adherence is required to maintain the metabolic changes. Further studies are needed to address this.

In conclusion, telephone counseling has been proven superior, in terms of health status improvement, compared to the usual care in MetS patients. While good outcomes are achievable through face-to-face counseling, adding telephone counseling to usual care offers a cost-effective measure to increase the effectiveness of present therapies for MetS patients.

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