ORIGINAL ARTICLE

Effect on Cardiovascular Risk of an Intervention by Family Physicians to Promote Physical Exercise Among Sedentary Individuals

Luis García-Ortiz,[a] Gonzalo Grandes,[b] Álvaro Sánchez-Pérez,[b] Imanol Montoya,[b]
José A. Iglesias-Valiente,[a] José I. Recio Rodríguez,[a] Yolanda Castaño-Sánchez,[a]
and Manuel A. Gómez-Marcos,[a] on behalf of the PEPAF group

[a]Unidad de Investigación de Atención Primaria, Centro de Salud la Alamedilla, REDIAPP, Salamanca, Spain
[b]Unidad de Investigación de Atención Primaria de Bizkaia, REDIAPP, Bilbao, Vizcaya, Spain

Introduction and objectives. To evaluate the effect of a program promoting physical activity (PEPAF) implemented by family physicians on cardiovascular risk reduction.

Methods. The cluster randomized clinical trial involved 56 family physicians randomly allocated to an intervention group (n=29) and a control group (n=27). Of the patients recruited, only those aged 30-74 years (1915 PEPAF and 1783 control) were included in the analysis. The intervention involved giving general advice about the benefits of physical activity to all patients and prescribed advice to a subgroup of patients (30%) who agreed to an additional consultation. Outcome measures included risk factors and cardiovascular risk assessed using the Framingham-D'Agostino scale.

Results. A significant decrease from baseline in systolic and diastolic blood pressure and pulse pressure was observed after 12 months in both groups (control group: –2.93 mm Hg, –1.81 mm Hg and –1.15 mm Hg, respectively; PEPAF group: –3.35 mm Hg, –1.4 mm Hg, and –1.94 mm Hg, respectively). The high-density lipoprotein cholesterol level increased (control group: +1.73 mg/dl; PEPAF group: +2.67 mg/dl), while the atherogenic index decreased (by 0.12 and 0.16 in the two groups, respectively), all from baseline ($P<.05$). Cardiovascular risk decreased by 0.68 (95% confidence interval [CI], 0.13-1.25) in the control group and 0.79 (95%CI, 0.22-1.35) in the PEPAF group. There was no significant difference in the improvement at 12 months between the groups.

Conclusions. Patients' participation in the project was effective in improving control of risk factors and decreasing cardiovascular risk. No significant difference in outcome was observed between the control group and the group participating in the program promoting physical activity.

Key words: *Physical exercise. Advice. Risk factors. Cardiovascular disease. Risk assessment.*

Efecto en el riesgo cardiovascular de una intervención para la promoción del ejercicio físico en sujetos sedentarios por el médico de familia

Introducción y objetivos. Evaluar el efecto de un programa de promoción de la actividad física (PEPAF) realizado por médicos de familia en la disminución del riesgo cardiovascular.

Métodos. Ensayo clínico por conglomerados en el que se asignó aleatoriamente a 56 médicos de familia a un grupo de intervención (n = 29) y un grupo de control (n = 27). Entre los pacientes reclutados, se analizó a los que estaban entre 30 y 74 años (1.915 PEPAF y 1.783 controles). Intervención: consejo sobre los beneficios de la actividad física a todos los pacientes y prescripción a un subgrupo que aceptó una consulta adicional (30%). Medidas: factores de riesgo y riesgo cardiovascular con la escala Framingham-D'Agostino.

Resultados. A los 12 meses se observó un descenso significativo de las presiones arteriales sistólica y diastólica y la presión de pulso en los dos grupos (controles, 2,93, 1,81 y 1,15 mmHg; PEPAF, 3,35, 1,4 y 1,94 mmHg) respecto a la evaluación basal. Hubo incremento del colesterol de las lipoproteínas de alta densidad (controles, 1,73 mg/dl; PEPAF, 2,67 mg/dl) y descenso del índice aterogénico (controles, 0,12; PEPAF, 0,16) respecto al basal (p < 0,05). El riesgo cardiovascular disminuyó en el grupo control 0,68 (intervalo de confianza [IC] del 95%, 0,13-1,25) y en el PEPAF, 0,79 (IC del 95%, 0,22-1,35). No se observaron diferencias significativas en la mejoría a los 12 meses entre el grupo PEPAF y el de controles.

Conclusiones. La inclusión de pacientes en el proyecto fue eficaz para mejorar el control de los factores de riesgo y reducir el riesgo cardiovascular; no se observaron diferencias entre el grupo de control y el que recibió promoción de la actividad física.

Palabras clave: *Ejercicio físico. Consejo. Factores de riesgo. Enfermedades cardiovasculares. Evaluación del riesgo.*

ABBREVIATIONS

ACSM: American College of Sports Medicine
AHA: American Heart Association
CI: confidence interval
BMI: body mass index
MET: metabolic equivalent
PEPAF: experimental program for physical
  activity promotion

INTRODUCTION

There is evidence of the association between a sedentary lifestyle and ischaemic heart disease as well as of the protective effect of exercise, regardless of the total amount of physical activity.[1-4] This effect increases with the intensity of the activity carried out. A dose-response association is therefore observed in the reduction of the risk of heart disease, with decreases of 4% for every metabolic equivalent (MET) increase in the intensity of physical activity.[5] This connection has also been found with strokes, decreasing their incidence rate and improving prognosis.[6] Moreover, physical activity modifies cardiovascular risk factors: systolic and diastolic blood pressure[7] drops, high density lipoprotein cholesterol (HDL-C) increases and low density lipoprotein cholesterol (LDL-C) and triglycerides[8] decreases.

Based on the proven benefits of aerobic exercise, the American College of Sports Medicine (ACSM) and the American Heart Association (AHA) recommend at least 30 minutes of moderate physical activity, 5 days a week, or 20 minutes of vigorous activity, 3 days a week.[9] However, in most developed countries, approximately 70% of the adult population does not follow these recommendations.[10,11]

In order for sedentary patients to become active, and thus to achieve the benefits that physical exercise produces, various strategies have been employed with different results.[12-14] Furthermore, to assess the benefits of physical activity, we used, above all, the increase in physical activity, physical fitness and the modification of certain risk factors.[13,14] However, its effect on cardiovascular risk, estimated with scales, was not usually assessed. The use of cardiovascular risk scales helps to assess in a comprehensive manner the improvement in the control of cardiovascular risk factors, and it may be useful to monitor the medium- and long-term effectiveness of physical activity.[15,16]

This study is part of an experimetal program to promote physical activity (PEPAF) which is carried out by general practitioners in their practice. Its main findings were published recently: the proportion of patients who accomplished the recommendations of physical activity was 4% higher in the intervention group.[17]

The aim of this paper is to evaluate the effect of the aforementioned program on the control of risk factors and on the estimated cardiovascular risk in a population of sedentary patients between 30 and 74 years of age.

METHOD

Design and Study Population

A detailed description of the clinical trial was published recently.[17,18] In brief, it constitutes a cluster-randomized clinical trial, which was carried out from October 2003 to December 2005 in 11 health centers across Spain, considering general practitioners as sampling units. The main reason for the cluster design was to avoid contamination, which would have otherwise occurred among the patients of one doctor, since the study is implemented by each of the doctors but the results correspond to each individual patient.

The 15 groups of the network for preventive activities and health promotion (REDIAPP) were invited to participate, provided that at least 4 doctors in each health center would take part. The study protocol was approved by the research ethics committees in each of the participating centers. In the end, 70 general practitioners from 13 health centers belonging to 8 REDIAPP groups agreed to participate. After signing a collaboration agreement, the doctors were randomly placed into the intervention group (PEPAF group) or in the normal care group (control group) at a 1:1 ratio, using a software program that was centralized and stratified by the health centers. The doctors were assigned anonymously to the comparison groups, using random numbers centrally generated by a computer at the Bizkaia Primary Healthcare Research Unit.

Two centers (12 doctors) left before starting the study because of technical problems, and two doctors refused to participate. Finally, 56 doctors (29 randomly placed into the PEPAF group and 27 to the control group) carried out the study in 11 primary healthcare centers.

The general practitioners recruited patients between the ages of 20 and 80 years who did not meet the aerobic physical activity recommendations of the ACSM (30 minutes of moderate physical activity, 5 days a week, or 20 minutes of vigorous

activity, 3 days a week).[9] To avoid selection bias, the candidates to be assessed by their general practitioner were selected using systematic sampling carried out by research nurses. They were selected from the list of patients referred for consultation according to the time of their appointment. After attending to the reasons for the consultation, the doctors assessed the patient's physical activity using an electronic algorithm. The computer program guided the doctors in the review of the exclusion criteria, which could efficiently preclude participation for patients who carried out regular physical activity, were under emotional stress, were pregnant on had follow-up difficulties. Patients signed the informed consent documents before the baseline measurement. The study was conducted via a web page, designed to assist doctors in monitoring the research protocol and controlling the recruitment process.

For this study, we selected 3698 patients between 30 and 75 years old to be assessed using the Framingham-D'Agostino cardiovascular risk scale,[16] which estimates overall cardiovascular risk, both cardiovascular and cerebrovascular, for this type of population group. The sample size is considered sufficient since—accepting an alpha risk of 0.05 and a beta risk of 0.20 in a bilateral contrast, a standard deviation of 5 points in the difference of cardiovascular risk between baseline and final assessment (since there were 56 clusters), and a 0.01 coefficient of intra-cluster correlation (ICC)—1232 patients were to be allocated in each group, ie, at least 2464. As the final number of participants was 2845 and the average number per cluster was 50, the minimum difference to be detected with a potential of 80% and an alpha risk of 5% was 0.65 units. The cluster sample size calculator (Health Service Research Unit, University of Aberdeen, United Kingdom) was used to estimate the sample size.

Finally, it should be noted that the intervention under evaluation was not designed to modify risk factors or reduce cardiovascular risk, but to increase physical activity in sedentary patients. Therefore, this constitutes an analysis of secondary objectives of the research carried out.

Intervention

The doctors assigned to the PEPAF group gave concise advice and educational materials to all patients and offered them an additional 15-minute consultation to prescribe an individualized exercise plan. The patients who accepted and those did not accept this additional offer formed the advice and prescription of physical activity subgroups, respectively.

The doctors were trained on the study, and advice and prescription of physical activity protocols. The quality of the intervention was ensured via a web page, which made it easier for doctors to perform a standardized intervention and to record the process followed for each patient.

The control group doctors carried out their usual care tasks and delayed any systematic intervention on physical activity until the end of the study, unless the motivation or the health problems of patients were directly related with physical inactivity. The training received was similar to that of the intervention group concerning the research procedures and the use of the web page to assess physical activity and develop the recruitment process.

Study Variables

The risk factors used by the D'Agostino scale[16] included age, total cholesterol, HDL-C and systolic blood pressure (SBP) as quantitative variables, and sex, use of antihypertensive medicines, smoking, and history of diabetes as dichotomous variables. The risk of cardiovascular morbidity and mortality was assessed using the published equation based on the study by Framingham.[16]

Blood pressure was measured using the OMRON M7® monitor (Omron Health Care, Ukyo-ku, Kyoto, Japan), according to the recommendations of the European Society of Hypertension.[19] The level of lipids and blood glucose was measured at the reference laboratory of each center, following the patient's fasting for at least 8 hours. The data of other risk factors and antihypertensive medicines were recorded on a questionnaire provided by the research nurse. Other variables that could constitute potential confusing factors, including employment status and education level, were collected in the same way.

The body mass index (BMI) was calculated as weight (kg) / height (m).[2] Waist circumference was the mean of 3 measurements made at the waist (at the midpoint between the last rib and the iliac crest, using a flexible measuring tape), parallel to the floor and measured after inspiration.

The research nurses were unaware of the group assigned to the participants and carried out their work at a physical activity laboratory, taking measurements of the patient (following his or her recruitment) at baseline and at 12 months.

Data Analysis

To describe the characteristics of the patients studied, we used the mean and standard deviation in quantitative variables and percentages in the qualitative ones. To compare the different

subgroups we used the $\#c^2$ test for qualitative variables. For quantitative variables, we used the Student t test if the qualitative variable pertained to 2 categories or the ANOVA test with the LSD method for later contrasts if the variable belonged to more than 2 categories. The analysis of changes in the variables analyzed between the PEPAF group and the control group was carried out for treatment purposes. To analyze changes in the variables between baseline assessment and assessment at 12 months we used the Student t-test for paired quantitative data and McNemar's test for qualitative variables. A multilevel analysis was performed, using the generalized mixed effects model, in order to make a multivariate adjustment among different patient groups at the patient level, taking into account the data structure: patients grouped by doctors and doctors grouped by medical centers.

As the study variables were not directly related to the intervention evaluated in the clinical trial and both groups' values were similar reduced at 12 months, they were considered to be random and were withdrawn from the analysis. We re-analyzed the data, drawing the baseline value for those who left the study at 12 months, obtaining almost identical results.

To estimate the effect of the intervention carried out between the baseline assessment and the assessment at 12 months, we used the following formula:

Effectiveness = [Assessment of the PEPAF group at 12 months - Assessment of the PEPAF group at baseline] - [Assessment of the control group at 12 months - Assessment of the control group at baseline].

The statistical significance was set at $P<.05$. The statistical analyzes were performed using the SPSS / PC+ software, version 15.0 (SPSS Inc., Chicago, Illinois, United States).

RESULTS

Of the 4317 sedentary patients who agreed to participate in the study, 3698 were between 30 and 74 years old. Of these, 1915 were randomly assigned to the PEPAF group (51.8%) and 1783 to the control group (48.2%). 1456 and 1389 subjectes, respectively, completed the study (Figure). The patients who left the project were slightly younger (52.6 vs 49.7 years), with a higher prevalence of women (71% vs 64%) and a lower cardiovascular risk (11.48% vs 12.87%).

Table 1 shows the sample's baseline characteristics, without differences between the PEPAF group and the control group, except for differences in age,

education level and the proportion of patients with hypertension and dyslipidemia, which were higher in the control group.

Table 2 shows the baseline values for risk factors and cardiovascular risk, with no difference between the 2 groups except in cardiovascular risk, which was higher in the control group (13.12%) than the PEPAF group (12.02%). Table 2 also displays the changes between the risk factors and cardiovascular risk taken at the baseline assessment and at the assessment at 12 months. A statistically significant decrease in systolic and diastolic blood pressure (control group: 2.93/1.81 mm Hg; PEPAF group: 3.35/1.40 mm Hg) and in pulse pressure (control group: 1.15 mm Hg; PEPAF group: 1.94 mm Hg) was noticeable at 12 months compared to the readings taken at baseline in both groups ($P<.05$). However, the BMI and waist circumference had not changed. Regarding lipids, there was an increase in HDL-C (control group: 1.73 mg/dL; PEPAF group: 2.67 mg/dL) and a decrease in the atherogenic index (control group 0.12; PEPAF group: 0.16) in both groups ($P<.05$). Tobacco consumption also dropped in both groups (control group: 13.4%; PEPAF group: 13.3%). Concerning the cardiovascular morbidity and mortality risk, estimated using the Framingham-D'Agostino score, we observed a statistically significant decrease at 12 months in both the PEPAF group (0.79 points; 95% CI, 0.22-1.35) and the control group (0.68; 95% CI, 0.13-1.25). Finally, concerning the effectiveness of the intervention, estimated as the improvement of risk factors and cardiovascular risk in the PEPAF group compared with the improvement obtained in the control group, Table 3 shows that there was no statistical significance in any of the parameters evaluated, except for a slight increase in HDL-C (95% CI, 0.08-1.81mg/dL). There were no relevant changes in the cardiovascular risk score after adjustment for age, sex, education level, hypertension, dyslipidemia, and diabetes.

DISCUSSION

This experimental program aimed at increasing physical activity in sedentary patients and implemented by general practitioners in their practice, was not effective in improving the control of risk factors, except for HDL-C, or the reduction of cardiovascular risk in the intervention group compared with the control group. However, it achieved a decrease in systolic blood pressure (between 2 and 3 mm Hg on average), diastolic blood pressure (between 1 and 1.5 mm Hg on average) and pulse pressure (between 1.4 and 1.7 mm Hg) in both groups. It also improved the lipid profile in both groups, with an increase of HDL-C and a decrease in the atherogenic index. Similarly, there
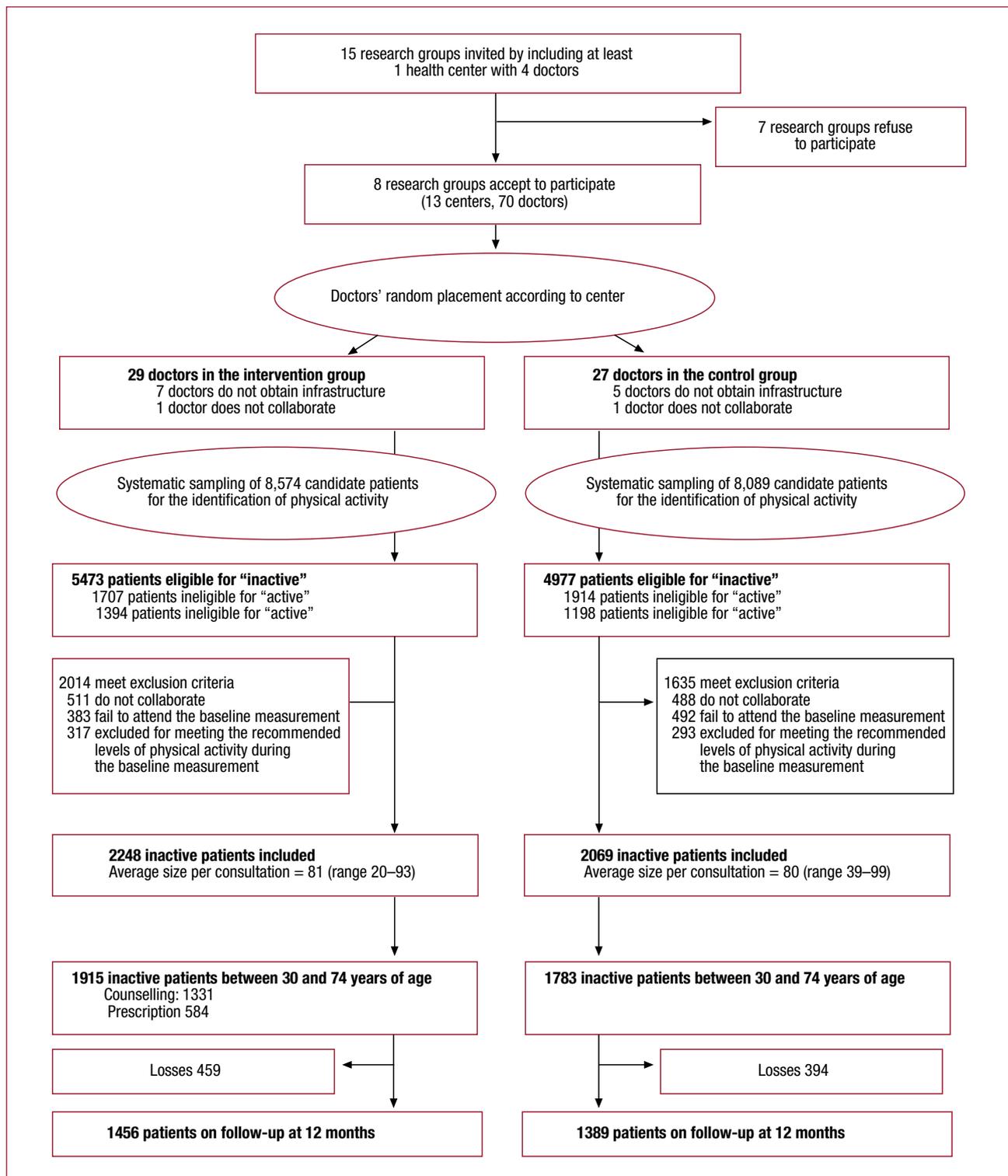
Figure 1. Flowchart of the PEPAF study (experimental program for the promotion of physical activity).

was a decline in smoking with regard to the baseline assessment in both groups. Finally, concerning cardiovascular risk as an overall measure of the program's ability to promote physical activity, which was estimated using the D'Agostino scale, there was a significant decrease in both groups in the assessment at 12 months, but without any differences between them. Although the decline is less than 1% of the risk that was considered to be of clinical relevance when estimating the sample size,

TABLE 1. Baseline Characteristics of 3698 Primary Care Sedentary Patients Between 30 and 74 Years of Age, Included in the PEPAF Study

	Control Group	PEPAF Group	P^a
No.1783	1915		
Age, mean (SD), y	52.38 (12.39)	51.47 (12.1)	.024
Female, %	1145 (64)	1272 (67)	.062
Employment status, n (%)			
Employment outside the household	890 (50)	989 (51)	.12
Housewife	461 (26)	515 (27)	.12
Pensioner	299 (17)	261 (14)	.12
Unemployed	77 (4)	91 (5)	.12
Others	56 (3)	59 (3)	.12
Education level, n (%)			
None	143 (8)	88 (5)	<.001
Primary education	997 (56)	1095 (57)	<.001
Secondary education	383 (21)	416 (22)	<.001
Higher education	260 (15)	316 (15)	<.001
Risk factors, n (%)			
Diabetes	168 (9)	155 (8)	.084
Hypertension	533 (30)	523 (27)	.044
Dyslipidemia	440 (25)	399 (21)	.003
Obesity (BMI>30)	474 (26)	527 (27)	.28
Antihypertensive medicines	426 (24)	429 (22)	.148
Tobacco consumption, n (%)			
Current smoker	508 (28)	578 (30)	.474
Former smoker	349 (20)	377 (20)	.474
Non-smoker	926 (52)	960 (20)	.474

Abbreviations: BMI, body mass index (calculated as weight in kilograms, divided by height in square meters); PEPAF, experimental program for the promotion of physical activity; SD, standard deviation.
[a]Multivariate Student t model, taking into account the conglomerate structure of the data for quantitative variables and chi-square test for qualitative variables.

it is very close to that figure and we must take into account the trend of the risk increasing over time due to age.

For the correct interpretation of these results, it is important to note that this paper does not assess the effect of physical activity on cardiovascular risk but the widely proven effect of a program promoting physical activity on such a risk. The potential benefit of this program on cardiovascular risk depends on its effectiveness in its original purpose: increasing levels of physical activity significantly. However, although the program was effective, the impact on physical activity was limited, and therefore its effect on cardiovascular risk may not be visible.[17]We should also note that the inclusion of patients in the study and in the measurements carried out could have been a motivating factor that contributed to improving risk factors and cardiovascular risk, since the change observed was similar in both the PEPAF group and the control group. This fact has already been described by Hardcastle et al[20] and Elley et al.[21] The main objective of Hardcastle was cardiovascular risk reduction and Elley's purpose

was the promotion of physical activity, both obtaining similar results. Neither study showed a decrease in the risk factors or cardiovascular risk in the intervention group compared with the control group; however, improvement was observed in both groups. In the study published by Hardcastle et al[20] the intervention group showed a decrease in diastolic blood pressure (0.08 to 4.06mm Hg) and in BMI (0.07 to 0.64), compared with that in the control group. The decrease achieved in the study carried out by Elley CR et al[21] in New Zealand in systolic blood pressure (intervention group: 2.58 mm Hg and control group: 1.21 mm Hg) and in diastolic blood pressure (intervention group: 2.62 mm Hg and control group: 0.81 mm Hg), without significant statistical differences, was also similar to the results of our study. Results were also similar to those reported by Whelton et al[7] in the meta-analysis on the effect of aerobic exercise on blood pressure (an average decrease of 3.8 PA/2.6 mm Hg). The study by Elley CR et al[21] also found no decrease in BMI or total cholesterol, but coronary risk improved, estimated at 4 years in both groups

TABLE 2. Baseline Assessment and Changes of Risk Factors and Cardiovascular Risk at 12 Months

	Baseline Assessment			Change at 12 Months Adjusted at Baseline[a]	
	Control Group (n=1783)	PEPAF Group (n=1915)	P	Control Group (n=1389)	PEPAF Group (n=1456)
SBP, mm Hg	129.92 (19.21)	130.03 (18.43)	.862	−2.93[b] (−5.40 to −0.47)	−3.35[a] (−5.81 to −0.89)
DBP, mm Hg	78.08 (10.59)	78.49 (10.67)	.242	−1.81[b] (−3 to −0.61)	−1.4[b] (−2.6 to −0.21)
Pulse pressure	51.85 (14.1)	51.57 (13.51)	.53	−1.15 (−2.94 to −0.64)	−1.94[b] (−3.72 to −0.14)
Heart rate	75.42 (11)	75.8 (11.42)	.31	−0.53 (−1.80 to − 0.73)	−0.53 (−1.8 to 0.74)
BMI	27.58 (4.66)	27.7 (4.63)	.431	0.02 (−0.08 to 0.13)	0.06 (−0.04 to 0.17)
Waist circumference	93.12 (13.02)	93.36 (13.09)	.574	0.37 (−0.53 to 1.26)	0.35 (−0.54 to 1.25)
Glycemia, mg/dL	99.19 (23.63)	98.13 (22.12)	.177	1.49[a] (0.43 to 2.56)	1.88[b] (0.83 to 2.94)
Total cholesterol, mg/dL	213.55 (36.29)	213.86 (38.58)	.81	−0.07 (−2.21 to 2.07)	0.87 (−1.27 to 3)
LDL cholesterol, mg/dL	133.53 (32.66)	134.22 (33.23)	.563	−1.24 (−3.44 to 0.97)	−2.14 (−4.36 to 0.08)
HDL cholesterol, mg/dL	58.32 (14.77)	57.64 (14.69)	.205	1.73[a] (0.61 to 2.85)	2.67[b] (1.54 to 3.8)
Triglycerides	114.76 (66.23)	118.01 (72.12)	.176	−1.9 (−5.19 to 1.39)	−0.95 (−4.21 to 2.3)
Atherogenic index	3.9 (1.15)	3.94 (1.13)	.362	−0.12[a] (−0.19 to −0.05)	−0.16[b] (−0.23 to −0.1)
Smoker, %	508 (28.49)	578 (30.2)	.137	−13.3%[a] (−10.2% to −17.2%)	−13.4%[b] (−10.4% to −17.1%)
F–D'Agostino CVR	13.12 (13.27)	12.02 (11.8)	.016	−0.68[a] (−1.25 to −0.13)	−0.79[b] (−1.35 to −0.22)

Abbreviations: Atherogenic index, total cholesterol/HDL-cholesterol; BMI, body mass index (calculated as weight in kilograms, divided by height in square meters); DBP, diastolic blood pressure; SBP, systolic blood pressure, F-D'Agostino CVR, cardiovascular risk by the 2008 Framingham-D'Agostino score; SD, standard deviation.
[a]Change adjusted for baseline measurements, considering the hierarchical structure of the data.
[b]$P<.05$. Multivariate Student t-model, taking into account the conglomerate structure of the data.

TABLE 3. Effect of the Intervention on Risk Factors and Cardiovascular Risk

Variable	Difference Attributable to PEPAF Multivariate Adjustment[a]	P[b]
SBP, mm Hg	−0.2 (−1.24 to 0.84)	.706
DBP, mm Hg	0.52 (−0.1 to 1.15)	.101
Pulse pressure	−0.58 (−1.25 to 0.1)	.094
Heart rate	−0.05 (−0.59 to 0.48)	.85
BMI	0.05 (−0.02 to 0.11)	.17
Waist circumference	0.04 (−0.27 to 0.35)	.809
Glycemia, mg/dL	0.52 (−0.61 to 1.65)	.366
Total cholesterol, mg/dL	0.87 (−1.44 to 3.19)	.458
LDL cholesterol, mg/dL	−0.91 (−2.9 to 1.08)	.372
HDL cholesterol, mg/dL	0.94 (0.08 to 1.81)	.033
Triglycerides	1.23 (−3.37 to 5.83)	.6
Atherogenic index	−0.04 (−0.1 to 0.03)	.279
Smoker, %	0. (−4.1% to 5.5%)	.99
F–D'Agostino CVR	−0.09 (−0.66 to 0.37)	.692

Abbreviations: Atherogenic index, total cholesterol/HDL-cholesterol; BMI, body mass index (calculated as weight in kilograms, divided by height in square meters); DBP, diastolic blood pressure; SBP, systolic blood pressure; F-D'Agostino CVR, cardiovascular risk by the 2008 Framingham-D'Agostino score.
[a]Adjusted for baseline measurements, age, sex, employment status, education level, diabetes, hypertension, dyslipidaemia and antihypertensive medicines, considering the hierarchical structure of the data.
[b]Multivariate Student t model, taking into account the conglomerate structure of the data.

(intervention group: 0.42 and control group: 0.52), without differences between them. Finally, Duna et al[22] found an effect similar to ours in the decrease in cardiovascular risk factors (blood pressure, lipids, and weight) in 2 groups with different intervention intensities, aiming to promote physical activity. Nevertheless, there was no difference in the degree of decline between them. In summary, the results obtained by other authors—although the main objective of the intervention carried out was not the same in all of the studies—are in line with those found in our study, where, rather than the actual intervention, the improvement achieved both in risk factors and cardiovascular risk may be related to the inclusion of these patients in the study.

Limitations

We should note some of the study's limitations. First, the intervention assessed was not designed to

modify risk factors or to reduce cardiovascular risk, but to increase physical activity in sedentary patients. Therefore, the results presented in this study are an analysis of the secondary objectives. Second, we should always bear in mind that there may be some individual variability in the clinical practice that may limit to some extent the homogeneity of the intervention. Third, although they were examined by different doctors, the fact that the patients of both the PEPAF group and the control group were from the same health center and that the measurement was performed by the same nurses, implies that a certain contamination effect cannot be excluded, which explains why risk factors and cardiovascular risk behaved in the same way in both groups. However, following the experts' recommendations, who believe that concerns regarding contamination are often exaggerated,[23] it was decided to randomize doctors by centers, because inter-center correlation may increase the study's strength. Lastly, we should take into account the high number of patients leaving the study (23%), in particular young women, thus participants with a lower cardiovascular risk.

CONCLUSIONS

The improvement achieved both in controlling factors and reducing cardiovascular risk is due to the inclusion of these patients in the project. There were no significant differences between the control group and the group that was encouraged to increase physical activity.

ACKNOWLEDGMENTS

REFERENCES

1. Sesso HD, Paffenbarger RS, Jr., Lee IM. Physical activity and coronary heart disease in men: The Harvard Alumni Health Study. Circulation. 2000;102:975-80.
2. Batty GD. Physical activity and coronary heart disease in older adults. A systematic review of epidemiological studies. Eur J Public Health. 2002;12:171-6.
3. Manson JE, Greenland P, LaCroix AZ, Stefanick ML, Mouton CP, Oberman A, et al. Walking compared with vigorous exercise for the prevention of cardiovascular events in women. N Engl J Med. 2002;347:716-25.
4. Myers J, Prakash M, Froelicher V, Do D, Partington S, Atwood JE. Exercise capacity and mortality among men referred for exercise testing. N Engl J Med. 2002;346:793-801.
5. Tanasescu M, Leitzmann MF, Rimm EB, Willett WC, Stampfer MJ, Hu FB. Exercise type and intensity in relation to coronary heart disease in men. JAMA. 2002;288:1994-2000.
6. Hu FB, Stampfer MJ, Colditz GA, Ascherio A, Rexrode KM, Willett WC, et al. Physical activity and risk of stroke in women. JAMA. 2000;283:2961-7.
7. Whelton SP, Chin A, Xin X, He J. Effect of aerobic exercise on blood pressure: a meta-analysis of randomized, controlled trials. Ann Intern Med. 2002;136:493-503.
8. Leon AS, Rice T, Mandel S, Despres JP, Bergeron J, Gagnon J, et al. Blood lipid response to 20 weeks of supervised exercise in a large biracial population: the HERITAGE Family Study. Metabolism. 2000;49:513-20.
9. Haskell WL, Lee IM, Pate RR, Powell KE, Blair SN, Franklin BA, et al. Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. Med Sci Sports Exerc. 2007;39:1423-34.

10. Martinez-Gonzalez MA, Varo JJ, Santos JL, de Irala J, Gibney M, Kearney J, et al. Prevalence of physical activity during leisure time in the European Union. Med Sci Sports Exerc. 2001;33:1142-6.

11. Meseguer CM, Galan I, Herruzo R, Zorrilla B, Rodríguez-Artalejo F. Actividad física de tiempo libre en un país mediterráneo del sur de Europa: adherencia a las recomendaciones y factores asociados. Rev Esp Cardiol. 2009; 62:1125-33.

12. Eakin E, Reeves M, Lawler S, Graves N, Oldenburg B, Del Mar C, et al. Telephone counseling for physical activity and diet in primary care patients. Am J Prev Med. 2009;36:142-9.

13. Foster C, Hillsdon M, Thorogood M. Interventions for promoting physical activity. Cochrane Database of Systematic Reviews 2005, Issue 1. Art. No.: CD003180. DOI: 10.1002/14651858.CD003180.pub2. Available from: http://www2.cochrane.org/ reviews/ en/ab003180.html.

14. Sorensen JB, Skovgaard T, Puggaard L. Exercise on prescription in general practice: a systematic review. Scand J Prim Health Care. 2006;24:69-74.

15. Conroy RM, Pyorala K, Fitzgerald AP, Sans S, Menotti A, de Backer G, et al. Estimation of ten-year risk of fatal cardiovascular disease in Europe: the SCORE project. Eur Heart J. 2003;24:987-1003.

16. D'Agostino RB Sr,Vasan RS, Pencina MJ, Wolf PA, Cobain M, Massaro JM, et al. General cardiovascular risk profile for use in primary care: the Framingham Heart Study. Circulation. 2008;117:743-53.

17. Grandes G, Sánchez A, Torcal J, Ortega Sánchez-Pinilla R, Lizarraga K, Serra J, Grupo (PEPAF). Atem Primaria. 2003;32:475-80.

18. Grandes G, Sanchez A, Sanchez-Pinilla RO, Torcal J, Montoya I, Lizarraga K, et al. Effectiveness of physical activity advice and prescription by physicians in routine primary care: a cluster randomized trial. Arch Intern Med. 2009;169:694-701.

19. Grandes G, Sanchez A, Torcal J, Sanchez-Pinilla RO, Lizarraga K, Serra J. Targeting physical activity promotion in general practice: characteristics of inactive patients and willingness to change. BMC Public Health. 2008;8:172.

20. O'Brien E, Asmar R, Beilin L, Imai Y, Mancia G, Mengden T, et al. Practice guidelines of the European Society of Hypertension for clinic, ambulatory and self blood pressure measurement. J Hypertens. 2005;23:697-701.

21. Hardcastle S, Taylor A, Bailey M, Castle R. A randomised controlled trial on the effectiveness of a primary health care based counselling intervention on physical activity, diet and CHD risk factors. Patient Educ Couns. 2008;70:31-9.

22. Elley CR, Kerse N, Arroll B, Robinson E. Effectiveness of counselling patients on physical activity in general practice: cluster randomised controlled trial. BMJ. 2003;326:793.

23. Dunn AL, Marcus BH, Kampert JB, Garcia ME, Kohl HW, Blair SN. Reduction in cardiovascular disease risk factors: 6-month results from Project Active. Prev Med. 1997;26:883-92.

24. Torgerson DJ. Contamination in trials: is cluster randomisation the answer? BMJ. 2001;322:355-7.