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Original

Influence of physical activity and dietary habits on lipid profile, blood pressure and BMI in subjects with metabolic syndrome

J. J. Muros Molina[1], M.ª J. Oliveras López[2], M.ª Mayor Reyes[3], T. Reyes Burgos[3] and H. López García de la Serrana[1]

[1]*Departamento de Nutrición y Bromatología. Facultad de Farmacia. Universidad de Granada. Granada. España.* [2]*Departamento de Biología Molecular e Ingeniería Bioquímica. Universidad Pablo de Olavide. Sevilla. España.* [3]*Hospital Clínico Universitario de Málaga. Málaga. España.*

Abstract

Background: The present study was determined the influence of physical activity and dietary habits on lipid profile, blood pressure (BP) and body mass index (BMI) in subjects with metabolic syndrome (MS).

Aims: Identify the relationship between physical activity and proper nutrition and the probability of suffering from myocardial infarction (MI).

Methods: Hundred chronically ill with MS who were active and followed a healthy diet were classified as compliant, while the remaining subjects were classified as non-compliant.

Results: The compliant subjects show lower BMI values (30.8 ± 4.9 _vs_ 32.5 ± 4.6), as well as lower levels of triacylglycerol (130.4 ± 48.2 _vs_ 242.1 ± 90.1), total cholesterol (193.5 ± 39 _vs_ 220.2 ± 52.3) and low-density lipoprotein cholesterol (105.2 ± 38.3 _vs_ 139.2 ± 45). They show higher values in terms of high-density lipoprotein cholesterol levels (62.2 ± 20.1 _vs_ 36.6 ± 15.3), with statistically significant differences. In terms of both systolic and diastolic pressure, no differences were revealed between the groups; however, those who maintain proper dietary habits show lower systolic blood pressure levels than the inactive subjects. The probability of suffering from MI greatly increases among the group of non-compliant subjects.

Conclusions: Our results demonstrate how performing aerobic physical activity and following an individualized, Mediterranean diet significantly reduces MS indicators and the chances of suffering from MI.

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Key words: *Physical activity. Dietary habits. Health. Metabolic syndrome.*

INFLUENCIA DE LA ACTIVIDAD FÍSICA Y LOS HÁBITOS NUTRICIONALES SOBRE EL PERFIL LIPÍDICO, PRESIÓN ARTERIAL E IMC EN SUJETOS CON SÍNDROME METABÓLICO

Resumen

Introducción: En el presente estudio se determinó la influencia de la actividad física y los hábitos nutricionales sobre el perfil lipídico, presión arterial (PA) e índice de masa corporal (IMC) en sujetos con SM.

Objetivos: Comprobar la relación entre realizar actividad física y una nutrición adecuada, y la posibilidad de sufrir infarto de miocardio (IM).

Método: Se evaluaron 100 sujetos con SM. Los sujetos que manifestaban ser activos y llevaban una alimentación saludable fueron clasificados como cumplidores, mientras que al resto se les clasificó como no cumplidores.

Resultados: Los sujetos cumplidores presentan valores menores en cuanto a su IMC (30,8 ± 4,9 _vs_ 32,5 ± 4,6) y sus niveles de triglicéridos (130,4 ± 48,2 _vs_ 242,1 ± 90,1), colesterol total (193,5 ± 39 _vs_220,2 ± 52,3) y colesterol unido a lipoproteínas de baja densidad (105,2 ± 38,3 _vs_ 139,2 ± 45); y valores mayores en los niveles de colesterol unido a lipoproteínas de alta densidad (62,2 ± 20,1 _vs_ 36,6 ± 15,3) siendo las diferencias estadísticamente significativas. La PA, tanto sistólica como diastólica, no muestra diferencias entre ambos grupos; en cambio el grupo que manifiesta realizar una alimentación adecuada obtiene unos niveles de presión arterial sistólica menores que el grupo que no la realiza. La posibilidad de padecer IM aumenta significativamente en el grupo de sujetos no cumplidores.

Conclusiones: Nuestros resultados muestran como la realización de actividad física de tipo aeróbica y llevar a cabo una alimentación individualizada de tipo mediterráneo reduce significativamente los parámetros relacionados con el SM y las posibilidades de sufrir IM.

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Palabras clave: *Actividad física. Hábitos dietéticos. Salud. Síndrome metabólico.*

Correspondence: José Joaquín Muros Molina.
Departamento de Nutrición y Bromatología.
Facultad de Farmacia. Universidad de Granada.
Campus de Cartuja, s/n.
E-mail: jjmuros@ugr.es

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Introduction

Metabolic syndrome (MS) refers to heterogeneous clustering of risk factors associated with increased probability of suffering from a cardiovascular disease (CVD) or diabetes mellitus (DM).[1,2] Such factors include abdominal obesity, hydrocarbon metabolism alterations or dysglycaemia, arterial hypertension and atherogenic dyslipidemia, with insulin-resistance as a common physiopathological base.[3]

At present, various authors consider physical inactivity to be one of the main problems affecting public health in the XXI century.[4] An increase in aerobic physical activity leads to an increase in aerobic capacity, which is inversely related to different health indicators, such as lipid profile, insulin-resistance, fat mass, MS indicators and arterial resistance.[5-9] Epidemiological studies demonstrate that performing moderate to vigorous physical activity daily prevents the incidence of chronic illnesses and premature death,[10] and when carried out according to certain criteria concerning the type, duration, intensity, frequency and progression of the activity,[11] it adapts to the individual's potential. In this way, the exercise helps to improve his or her health and assists the treatment of illnesses, especially coronary artery disease, arterial hypertension, DM, osteoporosis, colon cancer and depression, not to mention the way in which physical activity affects the development of obesity and CVD.[12-14]

In addition to a decrease in the performance of physical activity, social and technological changes imply transformations in dietary behaviours, such as an increased consumption of high-calorie foods rich in saturated fats, and a low consumption of unrefined carbohydrates. Some authors have emphasized that dietary treatment should vary, depending on the presence of different components of MS, and that treatment should be individualized according to the specific metabolic disorders affecting each patient.[15,16] It has been demonstrated that following a healthy diet, such as the Mediterranean diet, yields a negative relationship between the highest scores of adherence to such a diet and central obesity, fasting glycaemia and plasma triacylglycerols, and a positive relationship with HDL-C levels.[17]

The objective of this paper was to determine the influence of physical activity and dietary habits on lipid profile, blood pressure (BP) and body mass index (BMI) in subjects with MS. Likewise, the authors evaluated the influence of physical activity and proper nutrition on the probability of suffering from myocardial infarction (MI).

Methods

Sample

The sample group is representative of people chronically ill with MS. Selected participants are from a town in the province of Malaga (Spain) and receive treatment at a primary care nursing service which pays special attention to care for chronic patients. 100 subjects participated in the study, including 64 females and 36 males, with an average age of 68.4 ± 10.9. The MS diagnosis is made when an individual meets three of the five following diagnostic criteria (modified ATP-III): BMI > 28·8; BP ≥ 130/85 mmHg; high density lipoprotein cholesterol (HDL-C) < 40 mg/dl in males or < 50 mg/dl in females; triacylglycerols (TAG) ≥ 150 mg/dl; basal fasting glycaemia ≥ 110 mg/dl or receiving hypoglycaemia treatment, or the presence of previously diagnosed DM. Abdominal obesity was evaluated on the basis of a BMI ≥ 28.8 instead of abdominal circumference, a modification which has been validated previously in large cohorts.[18] All participants acted voluntarily, and the Declaration of Helsinki about ethics in research was respected. The University of Granada human research ethics committee approved this study.

Measurements

Body Composition: The anthropometric measurements were taken in the same place, by the same researcher, following all of the standards set by the International Society for the Advancement of Kinanthropometry (ISAK).[19] Height was measured with a stadiometer (GPM, Seritex, Inc., Carlstadt, New Jersey) with an exactness of 0.1 cm, and weight was determined on a portable scale (model 707, Seca Corporation, Columbia, Maryland) with an exactness of 0.1 kg. BMI was calculated as weight/height^2, with weight expressed in kilograms (kg) and height in meters (m).

Lipid Profile: All subjects were fasting since 12 hours before the experience started. The biochemical components were determined through blood analysis. Measured indicators included: total cholesterol (TC) (mg/dl), HDL-C (mg/dl), LDL-cholesterol (LDL-C) and TAG (mg/dl). In the laboratory, the blood serum and plasma were then separated to calculate the different fractions of the sample. Enzymatic methods were used.

Blood pressure: Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were measured weekly with mercury phygmomanometers, taken with the utmost care and following the method approved by international guidelines.[20] The BP levels were also determined *in situ* on the day of the consultation (casual BP).

Procedure

A clinical and nutritional interview was given to each subject, using a worksheet with multiple indicators, assessing life habits, cardiovascular risk factors, microand macro-vascular complications and dietary and/or pharmacological treatments. Also, BMI, BP and analytical determinations were calculated. The subject's level of physical activity was evaluated as sedentary or active, with sedentary patients performing fewer than 30 minutes of moderately intense aerobic exercise (between 55 and 60% of theoretical maximum cardiac frequency) per day. The level of physical activity was determined through recording cardiac frequency, using Polar RS800cx pulsometers. Through analyzing the written list of food provided by the patient or person responsible for his or her nutrition, as part of the sample is illiterate, the subjects were classified according to their adherence to proper nutrition, according to the nutritional recommendations set by the WHO and guidelines of the Mediterranean diet. Dietary treatment was performed in an individualized manner, depending on the specific metabolic disorders affecting each patient.[21] Subjects who met these two criteria (active and proper nutrition) were classified as compliant (C), while the remaining subjects were classified as non-compliant (NC).

Statistical analysis

Values were expressed as mean values with their standard errors. The obtained data was analyzed through the statistical package, SPSS 17.0. (SPSS, Inc.). After checking the normalcy of the variables and verifying the inexistence of significant gender-based differences, the t-test and non-parametric tests were performed, as applicable, in order to evaluate the statistical differences between the subjects characteristics in terms of various parameters. The χ^2 test was used to compare proportions.

Results

Figure 1 shows the prevalence of MS components among the sample groups. BMI, high basal glucose levels and high BP are the most common of these components among men, while women more commonly experience high glucose levels and BMI, and low levels of HDL-C. In all of the subjects, three of more of these components were altered.

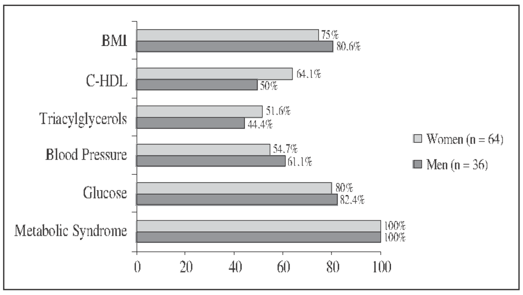

Fig. 1.—

Table I
Differences in MS-related parameters in accordance with level of physical activity

	Sedentary	*Active*	*P Value*
TAG	241.5 ± 95.9	150.9 ± 83.8	0.007[b]
HDL-C	35.9 ± 14.9	58.9 ± 21	0.000[c]
LDL-C	139.3 ± 45.2	111 ± 41.2	0.002[b]
TC	219 ± 52.7	200 ± 43.1	0.061
Glycaemia	154 ± 32.5	126.4 ± 28.3	0.001[b]
SBP	134.3 ± 17.5	133.9 ± 12.3	0.907
DBP	71.2 ± 9.3	72.5 ± 8.2	0.481
BMI	32.9 ± 4.5	30.5 ± 4.7	0.004[b]

$p < 0.05$[a], $p < 0.01$[b], $p < 0.001$[c] TAG: Triglycerides; HDL-C: High Density Lipoprotein Cholesterol; LDL-C: Low Density Lipoprotein Cholesterol; TC: Total Cholesterol; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; BMI: Body Mass Index.

Table I demonstrates how physically active subjects show lower BMI values, as well as lower TAG and LDL-C levels, with statistically significant differences. TC values were also lower, but the differences were not statistically significant. Active subjects have higher HDL-C levels, with statistically significant differences when compared with sedentary subjects. Systolic and diastolic blood pressure (SBP and DBP, respectively) revealed no differences between the two groups.

Table II displays the type of dietary habits adopted by the subjects. The results show how subjects who follow the WHO's nutritional recommendations have lower BMI values and TAG, LDL-c and TC levels, with statistically significant differences. Compared with those who do not follow these recommendations, compliant nutritional recommendations subjects have higher HDL-C levels, with statistically significant differences. Compared with non-compliant nutritional recommendations subjects, SBP revealed reductions in subjects who followed the dietary recommendations, with statistically significant differences, when comparing DBP did not reveal differences between the two groups after the dietary treatment.

Table II
Differences in MS-related parameters according to diet type

	Healthy diet	*Unhealthy diet*	*P Value*
TAG	143.2 ± 71.2	275.2 ± 110.5	0.000[c]
HDL-C	55.7 ± 21.1	33.1 ± 12.4	0.000[c]
LDL-C	115.8 ± 39.9	141.7 ± 48.2	0.005[b]
TC	198.7 ± 38.4	225.7 ± 57.1	0.006[b]
Glycaemia	166.1 ± 27.1	122.7 ± 24.4	0.000[c]
SBP	130.8 ± 14.9	137.9 ± 15.6	0.022[a]
DBP	71.1 ± 8.8	72.5 ± 9	0.449
BMI	31.1 ± 4.7	32.8 ± 4.6	0.026[a]

$p < 0.05$[a], $p < 0.01$[b], $p < 0.001$[c] TAG: Triglycerides; HDL-C: High Density Lipoprotein Cholesterol; LDL-C: Low Density Lipoprotein Cholesterol; TC: Total Cholesterol; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; BMI: Body Mass Index.

Table III
Differences in MS-related parameters according to degree of compliance

	C	NC	P Value
TAG	130.4 ± 48.2	242.1 ± 90.1	0.001[b]
HDL-C	62.2 ± 20.1	36.6 ± 15.3	0.000[c]
LDL-C	105.2 ± 38.3	139.2 ± 45	0.000[c]
TC	193.5 ± 39	220.2 ± 52.3	0.011[a]
Glycaemia	121.7 ± 25.5	154.8 ± 31.9	0.000[c]
SBP	133.9 ± 13	134.2 ±16.8	0.943
DBP	72 ±8.5	71.6 ± 9.1	0.851
BMI	30.8 ± 4.9	32.5 ± 4.6	0.026[a]

$p < 0.05^a$, $p < 0.01^b$, $p < 0.001^c$ TAG: Triglycerides; HDL-C: High Density Lipoprotein Cholesterol; LDL-C: Low Density Lipoprotein Cholesterol; TC: Total Cholesterol; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; BMI: Body Mass Index.

Table III demonstrates how C subjects show lower BMI values, as well as TAG, LDL-C and TC levels, with statistically significant differences. C subjects have higher HDL-C levels, with statistically significant differences in comparison with NC subjects. The two groups did not present differences in systolic and diastolic blood pressure.

Table IV shows how the probability of suffering from MI increases in a statistically significant way among the group of non-compliant subjects, compared with the group of compliant subjects.

Discussion

This study suggests that performing moderate physical activity on a regular basis significantly reduces various MS-related parameters. Subjects who perform this type of physical activity show lower values in terms of TC, LDL-C, TAG, glycaemia and BMI, and higher levels of HDL-C. These findings concur with previous studies which show that regular physical activity is an important protective factor against metabolic illnesses, as it prevents and reduces established atherosclerotic risk factors, including high TAG and low HDL cholesterol.[22-24] Studies such as that of Ekelund et al., performed on a sample of 3,193 young Europeans, demonstrate how performing a minor physical activity reveals a positive relationship with a lesser prevalence of MS after making adjustments for age and sex.[25]

Table IV
Incidence of myocardial infarction according to degree of compliance

	MI		P Value
	No	Yes	
C	50.7%	49.3%	0.004[b]
NC	18.2%	81.8%	

$p < 0.01^b$.

Our study shows how subjects who do not adopt proper dietary habits show greater MS-related parameters. A diet with excessive calorie intake is considered a risk factor for suffering from MS.[26] Various bibliographic references confirm that the ideal diet for preventing MS should be personalized and include healthy eating habits, which are beneficial not only for effective weight loss, but also for body weight maintenance and the reduction of CVD and MS-related parameters.[27]

In recent years, there has been increasing interest in implementing Mediterranean diets, as the effect of this type of diet on CVD- and MS-inducing parameters has been demonstrated.[28] Intervention studies such as ours show that following a Mediterranean diet reduces TC, LDL-C,[17] TAG[29] and BP levels due to the mono and polyunsaturated fats in olive oil,[30] and increases HDL-C values.[31]

MI control is essentially based on the management of risk factors, such as diabetes, dyslipidemia, hypertension, abdominal obesity and smoking. In recent times, and with more and more relevance, this control is based on lifestyle, with the pillars of diet and physical exercise.[32] Our study shows how compliant subjects have a lesser probability of suffering from MI. These results coincide with previous findings which demonstrate a relationship between physical inactivity, coronary artery disease and cardiovascular mortality,[33] and between following a healthy diet and the production of benefits in terms of morbidity among patients with acute myocardial infarction. The findings are in accordance with previous cohort studies which show that subjects who adhere to healthy lifestyles have less than one-tenth of the probability of suffering from MI that subjects who do not lead a healthy lifestyle have.[34-35]

Conclusions

Our results show how performing physical activity and adhering to an individualized, Mediterranean diet significantly reduces MS-related parameters. The results demonstrate the need to obtain more specific recommendations concerning the quantity and intensity of physical activity needed in order to prevent MS, as well as dietary studies which indicate the most effective diet for reducing MS-related parameters. Preventive efforts should focus on motivating people to improve their lifestyles. Governments and educational and health centres should joing forces to implement programs which incorporate physical activity and the promotion of a Mediterranean diet, and which assist with the prevention of MS.

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References

1. Aguilar-Salinas CA, Rojas R, Gómez-Pérez FJ et al. The Metabolic Syndrome: a concept hard to define. *Arch Med Res* 2005; 36: 223-31.
2. Son le NT, Kunii D, Hung NT et al. The metabolic syndrome: prevalence and risk factors in the urban population of Ho Chi Minh City. *Diabetes Res Clin Pract* 2007; 67: 243-50.
3. Guize L, Thomas F, Pannier B et al. All-cause mortality associated with specific combinations of the metabolic syndrome according to recent definitions. *Diabetes Care* 2007; 30: 2381-2387.
4. Blair SN. Physical inactivity: the biggest public health problem of the 21st century. *Br J Sports Med* 2009; 43: 1-2.
5. Eisenmann JC, Katzmarzyk PT, Perusse L et al. Aerobic fitness, body mass index, and CVD risk factors among adolescents: the Quebec family study. *Int J Obes (Lond)* 2005; 29: 1077-1083.
6. Gutin B, Yin Z, Humphries MC et al. Relations of body fatness and cardiovascular fitness to lipid profile in black and white adolescents. *Pediatric Res* 2005; 58: 78-82.
7. Reed KE, Warburton DE, Lewanczuk RZ et al. Arterial compliance in young children: the role of aerobic fitness. *Eur J Cardiovasc Prev Reabil* 2005; 12: 492-497.
8. Mesa JL, Ruiz JR, Ortega FB et al. Aerobic physical fitness in relation to blood lipids and fasting glycemia in adolescents: Influence of weight status. *Nutr Metab Cardiovasc Dis* 2006; 16: 285-293.
9. Ruiz JR, Rizza NS, Hurtig-Wennlof A et al. Relation of total physical activity and intensity to fitness and fatnees in children: the European Youth Heart Study. *Am J Clin Nutr* 2006; 84: 299-303.
10. Warburton DE, Nicol CW & Bredin SS. Health benefits of physical activity: the evidence. *CMAJ* 2006; 174: 801-9.
11. Haskel W, Lee IM, Pate RR et al. Physical activity and public health, update recommendations for adults from the American College of Sport Medicine and the American Heart Association. *Med Sci Sports Excerc* 2007; 39: 1423-34.
12. Bauman AE. Updating the evidence that physical activity is good for health: an epidemiological review 2000-2003. *J Sci Med Sport* 2004; 7 (Suppl. 1): S6-S19.
13. Misra KB, Endemann SW & Ayer M. Leisure time physical activity and metabolic syndrome in Asian Indian immigrants residing in northern California. *Ethn Diseases* 2005; 15: 627-34.
14. Duclos M. Prevention and treatment of the metabolic syndrome: role of physical activity. *Sci Sports* 2007; 22: 129-34.
15. Brehm BJ & D'Alessio DA. Benefits of high-protein weight loss diets: enough evidence for practice? *Curr Opin Endocrinol Diabetes Obes* 2008; 15: 416-421.
16. Hession M, Rolland C, Kulkarni U et al. Systematic review of randomized controlled trials of low carbohydrate vs low-fat/low-calorie diets in the management of obesity and its comorbidities. *Obes Rev* 2009; 10: 36-50.
17. Lohse B, Psota T, Estruch R et al. Eating competence of elderly Spanish adults is associated with a healthy diet and a favorable cardiovascular disease risk profile. *J Nutr* 2010; 140: 1322-27.
18. Ridker PM, Buring JE, Cook NR et al. C-reactive protein, the metabolic syndrome, and risk of incident cardiovascular events: an 8-year follow-up of 14,719 initially healthy American women. *Circulation* 2003; 107: 391-7.
19. Marfell-Jones M, Olds T, Stewart A et al. International standards for anthropometric assessment. ISAK: Potchefstroom, South Africa, 2006.
20. Lombera F, Barrios V, Soria F et al. Guías de práctica clínica de la Sociedad Española de Cardiología en hipertensión arterial. *Rev Esp Cardiol* 2000; 53: 66-90.
21. Muzio F, Mondazzi L, Harris WS et al. Effects of moderate variations in the macronutrient content of the diet on cardiovascular disease risk factors in obese patients with the metabolic syndrome. *Am J Clin Nutr* 2007; 86: 946-951.
22. Warburton DE, Nicol CW & Bredin SS. Health benefits of physical activity: the evidence. *CMAJ* 2006; 174: 801-9.
23. Lakka TA & Laaksonen DE. Physical activity in prevention and treatment of the metabolic syndrome. *Appl Physiol Nutr Metab* 2007; 32: 76-88.
24. Méndez-Hernández P, Flores Y, Siani C et al. Physical activity and risk of Metabolic Syndrome in an urban Mexican cohort. *BMC Public Health* 2009; 9: 276.
25. Ekelund U, Anderssen S, Andersen LB et al. Prevalence and correlates of the metabolic syndrome in a population-based sample of European youth. *Am J Clin Nutr* 2009; 89: 90-96.
26. Giugliano D, Ceriello A & Esposito K. The effects of diet on inflammation: emphasis on the metabolic syndrome. *J Am Coll Cardiol* 2006; 48: 677-685.
27. Abete I, Astrup A, Martínez JA et al. Obesity and the metabolic syndrome: role of different dietary macronutrient distribution patterns and specific nutritional components on weight loss and maintenance. *Nutr Rev* 2010; 68 (Suppl. 4): S214-S231.
28. Trichopoulou A, Orfanos P, Norat T et al. Modified mediterranean diet and survival: EPIC-elderly prospective cohort study. *BMJ* 2005; 30: 991-5.
29. Appel LJ, Sacks FM, Carey VJ et al. Effects of protein, monounsaturated fat, and carbohydrate intake on blood pressure and serum lipids. Results of OmniHeart Randomized Trial. *JAMA* 2005; 294: 2455-64.
30. Myers VH & Champagne CM. Nutritional effects on blood pressure. *Curr Opin Lipidol* 2007; 18: 20-24.
31. Pérez-Jiménez F, Álvarez de Cienfuegos G, Badimon L et al. International conference on the healthy effect to of virgin olive oil. *Eur J Clin Invest* 2005; 35: 421-424.
32. Lichtenstein AH, Appel LJ, Brands M et al. Diet and lifestyle recommendations revision 2006. A scientific statement from the American Heart Association Nutrition Committee. *Circultion* 2006; 114: 82-96.
33. Paterno CA. Factores de riesgo coronario en la adolescencia. Estudio FRICELA. *Rev Esp Cardiol* 2005; 58: 1411-9.
34. Aldana SG, Greenlaw RL, Diehl HA et al. The effects of a worksite chronic disease prevention program. *J Occup Environ Med* 2005; 47: 558-64.
35. Lara A, Yancey MK, Tapia-Conyer R et al. Pausa para tu salud: reduction of weight and waistlines by integrating exercise breaks into workplace organizational routine. *Prev Chronic Dis* 2008; 5: 1-9.