Observational Study

Medicine®

OPEN

Evaluation of the physical activity level, nutrition quality, and depression in patients with metabolic syndrome

Comparative study

İsmet Kazaz, Msc[a], Ender Angın, PhD[b,*], Seray Kabaran, PhD[b], Gözde İyigün, PhD[b], Berkiye Kırmızıgil, PhD[b], Mehtap Malkoç, PhD[b]

Abstract

Metabolic syndrome (MetS) is a complex problem that contains risk factors related with obesity, cardiovascular diseases, and type-II diabetes. The incidence of MetS is increasing every year throughout the world.

The aim of this study was to evaluate and compare physical activity levels, nutrition quality, and depression status of the individuals who are diagnosed with and without MetS.

International Physical Activity Questionnaire (IPAQ), Mediterranean Diet Adherence Screener (MEDAS), Beck Depression Inventory (BDI) was used. In addition, biochemical analysis and anthropometric measurements were also taken.

According to IPAQ, 81.1% of the MetS group is inactive, 6.8% is active, and 5.1% is highly active, whereas 22.3% of the non-MetS group is inactive, 46.2% is active, and 31.5% is highly active. MEDAS was found to be lower in the MetS group. BDI levels were also determined high in the MetS group.

Sedentary lifestyle, depression, and unhealthy nutrition habits are among the significant factors for the development of MetS. The knowledge levels of the people should be increased by developing national physical activity and nutrition guidelines.

Abbreviations: BDI = Beck Depression Inventory, BMI = body mass index, HDL = high-density lipoprotein, IPAQ = International Physical Activity Questionnaire, LDL = low-density lipoprotein, MEDAS = Mediterranean Diet Adherence Screener, MetS = metabolic syndrome, NCEP:ATPIII = National Cholesterol Education Program Adult Treatment Panel III, PA = physical activity, PREDIMED = Prevention con Dieta Mediterranean, WC = waist circumference, WHO = World Health Organization.

Keywords: depression, metabolic syndrome, nutrition, physical activity, public health

1. Introduction

Atherogenic dyslipidemia, high blood pressure, insulin resistance, high blood glucose, obesity, and abdominal obesity are among the components of metabolic syndrome (MetS). Therefore, MetS is a complex problem that contains risk factors related with obesity, cardiovascular diseases, and type-II diabetes.[1] The incidence of MetS is increasing every year throughout the world.[2,3] It is estimated that MetS affects approximately 20% to 30% of the population of the world.[4,5]

MetS is accepted as a disease caused by the modern lifestyle. MetS is mostly seen in the individuals who have unhealthy nutrition habits, who have insufficient physical activity (PA) level, and who are under stress.[6,7] Besides these, obesity and metabolic disorders affected the quality of life negatively.[8] Furthermore, few studies have focused the relationship of MetS with depression.

PA enables both physical and psychological development as well as establishes the basis of the daily life activities of individuals. Maintaining health mainly depends on the frequency and intensity of PAs in the daily life. Changing lifestyles according to the rapidly increasing industrial and technological developments and decreases in the daily activity levels of individuals increase the tendency for a sedentary lifestyle. In the studies that were carried out in the recent years, it is stated that sedentary lifestyle leads to serious health problems.[7,9] Physical inactivity, which is accepted as one of the common risk factors of chronic diseases, is at the fourth leading risk factor for global mortality. It also constitutes 6% of the causes of death throughout the world.[10]

Unhealthy nutrition habits that emerged parallel to the increase of the inactive lifestyle are among the most significant reasons for the increase in obesity.[1] The changes that emerged in dietary habits also contribute to the development of MetS.[11] According to the previous studies, it is found that the adults living in Cyprus have an excessive energy and fat intake.[12] In addition, it is seen that the prevalence of obesity is high and they have metabolic disease risk in accordance with their waist circumference (WC).[13]

Editor: Marcello Iriti.

The authors report no conflicts of interest.

[a] *Eastern Mediterranean University, Faculty of Health Sciences, Physiotherapy and Rehabilitation Department.,* [b] *Eastern Mediterranean University, Faculty of Health Sciences, Nutrition and Dietetics Department, Famagusta, North Cyprus via Mersin 10, Turkey.*

[*] *Correspondence: Ender Angın, Eastern Mediterranean University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Famagusta, North Cyprus via Mersin 10, Turkey (e-mail: ender.angin@emu.edu.tr).*

Medicine (2018) 97:18(e0485)

Received: 27 December 2017 / Received in final form: 27 March 2018 / Accepted: 28 March 2018

http://dx.doi.org/10.1097/MD.0000000000010485

This study will improve health-related policies and strategies of the countries that have similar problems. Because of these, the study is carried out in order to assess the PA level, dietary qualities, and depression status of the individuals and compare the differences between the groups.

2. Methods

2.1. General plan of research

A group that is diagnosed with MetS and a group that is not diagnosed with MetS (non-MetS) are compared in this study. The study was conducted between February and December 2015. Sample size of the study was calculated by using $n = z^2 * (p * (1-p))/d^2$ formula. [z=1.96 (level of confidence measure); $P=.5$ (baseline levels of the MetS in North Cyprus); d=0.04 (margin of error)]. Using these, the initial sample size was calculated as 600 individuals. For the possible drop outs, we increased the sample size by 10%. The number of the individuals who participated in the study was 660 individuals with MetS and 660 non-MetS individuals. The patients who were included in METs group have chosen in the patients applying to the internal medicine service (specialist in endocrine medicine) in the Dr. Burhan Nalbantoğlu State Hospital. The diagnosis for MetS was assessed in accordance with the MetS diagnosis criteria of National Cholesterol Education Program Adult Treatment Panel III (NCEP: ATPIII)[14] by the specialist doctors of Dr. Burhan Nalbantoğlu State Hospital, which is the biggest state hospital in North Cyprus. There are inpatient and outpatient services in the hospital. Dr. Burhan Nalbantoğlu State Hospital has advanced laboratory facilities in different departments. The Annual outpatient capacity of the hospital was 187.741 (from 331.432 according to the 2015 population census in Northern Cyprus) in 2015.[15] Non-MetS individuals were recruited from MetS' neighbors. While individuals among 30 to 55 years of age were included in the study, individuals having orthopedic and neurologic diseases, having serious respiratory problems, having serious sight, hearing, and speech disorders were excluded. Demographic characteristics of the individuals who participated in the study were questioned with a survey form. General information on the study was given to the individuals and an informed consent form was read and signed. The study was found to be suitable in terms of ethics by the Eastern Mediterranean University, Health Ethical Subcommittee (ETK00–2016–35).

2.2. Anthropometric measurements

The body weight of the individuals who participated in the study was taken by electronic scale; their height and WC were taken by a rubber measuring tape, their skinfold thickness (biceps, triceps, subscapula, and suprailiac) was taken with skinfold caliper, and the total skinfold thickness (sum of the 4 skinfolds) was calculated (in mm). Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters.[16] WC was measured midway between the lowest rib and the iliac crest.[17]

2.3. Measurements and laboratory tests

Blood sample was collected from the individuals participated in the study after 12 hours of hunger and their biochemical analysis was made at the Biochemistry Laboratory. Total cholesterol, high-density lipoprotein (HDL), low-density lipoprotein (LDL), triglyceride, fasting glucose levels were analyzed in the blood samples. Systolic and diastolic blood pressure levels were measured for all of the individuals.

2.4. Assessment of physical activity level

The long form of International Physical Activity Questionnaire (IPAQ) survey was used to gather detailed information on work activities, transport activities, house-garden activities, and free time activities.[18] Turkish validity study was conducted.[19]

2.5. Assessment of total numbers of daily step

All of the individuals were given a pedometer device; they were asked to carry them on from the moment they get up in the morning until the moment they go to bed at night and their total numbers of step that were taken in a day were assessed.[20]

2.6. Assessment of dietary quality level

The 14-item Mediterranean Diet Adherence Screener (MEDAS) was used for the assessment of dietary habits of individuals. MEDAS[21] was developed to rapidly control for compliance with the dietary intervention of the Prevention con Dieta Mediterranea (PREDIMED) study, a multicenter clinical trial aimed at assessing the effects of the traditional Mediterranean diet on the primary prevention of cardiovascular disease.[22] Therefore, the MEDAS consists of 12 questions on food consumption frequency and 2 questions on food intake habits considered characteristic of the Mediterranean diet. Each question was scored 0 or 1.[23]

2.7. Assessment of depression level

Beck Depression Inventory (BDI) was used for the assessment of depression in the study. BDI is composed of 21 items that are accepted as depressive symptoms such as pessimism, self-dissatisfaction and loss of appetite, uneasiness, indecision, fatigue, sense of failure, guilt, sleep disorder, and social withdrawal. In each item, 4-degree self-assessment statements that determine a behavior specific to depression are included.[24] Turkish validity and reliability of BDI was performed by Hisli.[25]

2.8. Statistical assessments

Statistical analyses were carried out using the IBM, SPSS 20.0 software (SPSS, Inc., Chicago, IL). A priori sample size calculation was performed using the G*Power version 3.1.9.2 for Windows (Universitat Kiel, Germany). Whether the data were normally distributed was assessed with the Kolmogorov–Smirnov test. The results are given as mean ($\overline{X}$) ± standard deviation (SD), with numbers. Chi-square test, t test, 1-way analysis of variance, and Kruskal Wallis analysis of variance were used in the calculations. Significance level was set at $P<.05$.

3. Results

According to the general demographic characteristics, there was no statistical difference between the MetS and non-MetS groups except educational status (Table 1).

It was found that 27.7% of individuals with MetS and 48.5% of individuals with non-MetS done PA regularly ($X^2=64.27$, $P=.000$). The individuals were divided into 3 groups that are inactive, active, and highly active according to IPAQ. It was stated that 81.1% of the individuals with MetS were inactive, 6.8% were active, and 5.1% were highly active, whereas 22.3%

Table 1

Distribution of Mets and non-Mets groups in accordance with their sociodemographic characteristics.

	Non-MetS		MetS		Total			
	n	%	n	%	n	%	X^2	*P*
Gender								
Female	310	47.0	310	47.0	620	47.0		
Male	350	53.0	350	53.0	700	53.0		
Total	660	100.0	660	100.0	1320	100,0	0.44	.506
Educational status								
Primary school	20	3.1	65	9.6	85	5.3		
Secondary school	35	5.3	68	9.9	103	10.2		
High school	222	33.6	244	37.2	466	34.2		
University	383	58.0	283	43.3	666	50.3		
Total	660	100.0	660	100.0	1320	100.0	39.28	**.000***
Work								
Self employed	23	3.9	23	3.4	46	3.7		
Private sector employee	182	27.6	196	29.8	378	28.7		
Civil servant	433	64.6	398	61.1	831	62.8		
Unemployed	22	3.9	43	5.7	65	4.8		
Total	660	100.0	660	100.0	1320	100.0	3.89	.273

Comparison of Chi-square test qualitative data.
* $P < .05$.

of the non-MetS individuals were inactive, 46.2% were active, and 31.5% were highly active ($X^2 = 596.84$, $P = .000$) (Table 2). Number of daily steps, MEDAS score, and BDI score were found significantly difference between the groups (Table 3). No statistically significant difference was found among the average age and height values of MetS and non-MetS groups ($P > .05$; Table 4). On the contrary, there was a significant difference in the statistics of body weight, BMI, WC, and total skinfold thickness ($P < .05$). The average body weight was found 82.3 ± 15.59 kg, 69.08 ± 11.90 kg, WC was 103.3 ± 11.41 cm, 90.97 ± 10.61 cm, total skinfold thickness was 70.59 ± 19.87 mm, 46.44 ± 14.39 mm, and BMI was 31.34 ± 5.64 kg/m^2, 25.08 ± 5.23 kg/m^2 in the MetS and non-MetS groups, respectively. As it can be seen in Table 5, a statistically significant difference was found among the biochemical blood parameters and blood pressure levels of MetS and non-MetS groups ($P < .05$). HDL was found to be 38 and 50 mg/dL, LDL was found to be 150 and 134 mg/dL, fasting glucose level was found to be 118 and 93 mg/dL, triglyceride was found to be 223 and 102 mg/dL, and total cholesterol was found to be 229 and 203 mg/dL in the MetS group and non-MetS group, respectively. The systolic blood pressure was 116 mm Hg, and diastolic blood pressure was 74 mm Hg in the MetS group, whereas the systolic blood pressure was 108 mm Hg and diastolic blood pressure was 68 mm Hg in the non-MetS group.

4. Discussion

Due to the changing lifestyles as a result of the rapidly increasing industrial and technological developments in the century we live, changes in the PA levels, nutrition habits, health status, and stress levels of individuals were observed. The studies show that the risk of MetS increases with the history of smoking, increase of age, and low education level.[26,27] In this study, when the distribution of MetS and non-MetS individuals is analyzed for their education levels, it is found that approximately 43% of the MetS individuals and 58% of the non-MetS individuals are graduated from a university. Parallel to the other studies that are seen in the literature, these data show that the incidence of MetS is affected from the education level. Moreover, it is known that the risk of MetS prevalence increases with the increase of age.[28] Factors related with lifestyle such as PA levels, dietary habits, and stress affect the prevalence of MetS.[6,7] The studies show that changes of lifestyle related with exercise and nutrition have significant importance for the decrease of factors related with MetS.[29–33] It is emphasized that decreasing the time spent in front of the

Table 2

Physical activity status of MetS and non-MetS groups and their distribution according to IPAQ.

	Non-MetS		MetS		Total			
	N	%	N	%	N	%	X^2	*P*
Regular PA								
Does	320	48.5	183	27.7	503	38.1		
Does not	340	51.5	477	72.3	817	61.9		
Total	660	100.0	660	100.0	1320	100.0	64.27	**.000***
IPAQ								
Inactive	147	22.3	582	88.1	729	55.2		
Active	305	46.2	45	6.8	350	26.5		
Highly active	208	31.5	33	5.1	241	18.3		
Total	660	100.0	660	100.0	1320	100.0	596.84	**.000***

IPAQ = International Physical Activity Questionnaire, PA = physical activity, comparison of *t* test quantitative data in independent groups.
* $P < .05$.

Table 3

Comparison of total number of daily steps, dietary quality, and Beck depression inventory scores of MetS and non-MetS groups.

	Group	N	X ± SD	T	P
NDS	MetS	660	3937.43 ± 2.88	11.01	**.000***
	Non-MetS	660	5594.08 ± 3.13		
MEDAS	MetS	406	7.19 ± 1.63	1.95	**.020***
	Non-MetS	410	8.66 ± 1.60		
BDI	MetS	660	7.29 ± 7.52	4.96	**.000***
	Non-MetS	660	4.28 ± 5.65		

BDI = Beck Depression Inventory, *t* test, MEDAS = Mediterranean Diet Adherence Screener, NDS = number of daily steps.
* $P < .05$.

television and increasing PA level are very important against the MetS.[34] PA level is evaluated in this study as well and it is found that approximately 81% of the individuals who having MetS and 22% of the individuals that having non-MetS are inactive. In a study carried out by Fruge et al, it is found that individuals with MetS are less active when they are compared with the non-MetS individuals.[37] In a different study carried out by Petersen et al, individuals who are inactive in their free times have a higher risk of MetS when they are compared with active individuals.[38]

In addition, healthy adults are expected to walk approximately 10,000 steps a day. In the assessment carried out with pedometer, adults are assessed as 'sedentary lifestyle index' for <5000 steps/day; 'low active' for 5000 to 7499 steps/day; 'somewhat active' for 7500 to 9999 steps/day, and active for ≥10,000 steps/day.[20] Cocate et al stated that male adults who have ≥10,000 steps/day have a better cardiometabolic condition when compared with adults who have <10,000 steps/day. In addition, they have found that there is an inverse correlation between the increase of the number of steps with adiposity, insulin resistance, and MetS.[39] Daily number of steps are assessed in the study that was conducted by Newton et al; it is determined that the risk of prevalence of MetS increases in older adults who have <3717 steps/day. Moreover, they also show that there is a correlation between the increase of number of daily steps and the decrease of the prevalence of MetS.[40] In this study, the total number of daily steps is found as 3937 steps/day in individuals having MetS and 5594 steps/day in non-MetS individuals in average. Accordingly, a sedentary lifestyle stands out in the individuals who having MetS. These data also show that the adults both have MetS and individuals who are non-MetS have low PA levels.

Moreover, in the previous studies, it is shown that there can be a correlation between the dietary habits and MetS.[30,35,36,40] It is emphasized that a lifestyle that is particularly suitable with the Mediterranean diet may decrease the risk of MetS.[30,41,42] With regards to this, in this study, it is found that individuals having MetS have a lower MEDAS score in comparison with the non-MetS group. The fundamental characteristic of the Mediterranean diet is having food diversity. Foods such as vegetables, fruit, bread and other cereals, legumes, and oil seeds are seen frequently in the Mediterranean diet. Olive oil is preferred as the main oil source in the Mediterranean diet as well. Consuming red meat once or twice a month, consuming fish twice a week, moderate alcohol consumption with meals are among the other characteristics of the Mediterranean diet. Therefore, it is considered that the Mediterranean diet can form a sufficient and balanced nutrition sample. The Mediterranean diet has protective effects on health with that characteristic.[43,44]

As antioxidants, phenolic components, bioactive compounds as well as unsaturated fatty acid intake is high with the Mediterranean diet; it helps the risk of chronic disease to decrease.[44,45] The studies show that as adopting the Mediterranean diet increases, BMI, WC, fasting blood glucose, and triglyceride levels decrease and HDL cholesterol level increases.[46,47] It is stated that the meta-analysis of 50 clinical, prospective, and cross-sectional studies show that as the Mediterranean diet has positive effects on the WC, HDL cholesterol, triglycerides, blood pressure, and blood glucose levels; it has a protection from the MetS.[42] In this study, the MetS group has significantly higher levels of systolic and diastolic blood pressure, fasting blood glucose, triglyceride, total cholesterol, LDL-cholesterol and lower levels of HDL cholesterol

Table 4

Comparison of anthropometric measurements of MetS and non-MetS groups.

	Group	N	X ± SD	t	P
Age	MetS	660	43.37 ± 7.34	1.10	.271
	Non-MetS	660	43.99 ± 7.13		
Height	MetS	660	167.20 ± 8.46	1.49	.135
	Non-MetS	660	167.89 ± 8.45		
Body weight	MetS	660	82.39 ± 15.59	17.48	**.000***
	Non-MetS	660	69.08 ± 11.90		
Waist	MetS	660	103.31 ± 11.41	20.36	**.000***
	Non-MetS	660	90.97 ± 10.61		
Total SFT	MetS	660	70.59 ± 19.87	25.40	**.000***
	Non-MetS	660	46.44 ± 14.39		
BMI	MetS	660	31.34 ± 5.64	20.90	**.000***
	Non-MetS	660	25.08 ± 5.23		

BMI = body mass index, SFT = Skinfold Thickness, *t* test.
* $P < .05$.

Table 5

Comparison of biochemical blood parameters and blood pressure levels of MetS and non-MetS groups.

	Group	N	X ± SD	*t*	*P*
HDL	MetS	660	38.95 ± 10.08	18.23	.000*
	Non-MetS	660	50.23 ± 12.24		
LDL	MetS	660	150.74 ± 43.77	7.44	.000*
	Non-MetS	660	134.54 ± 35.05		
Glucose	MetS	660	118.21 ± 47.90	12.87	.000*
	Non-MetS	660	93.51 ± 13.59		
Triglyceride	MetS	660	223.94 ± 126.06	24.02	.000*
	Non-MetS	660	102.70 ± 35.33		
Cholesterol	MetS	660	229.77 ± 49.83	10.27	.000*
	Non-MetS	660	203.37 ± 43.45		
Systolic blood pressure	MetS	660	116.67 ± 13.79	11.25	.000*
	Non-MetS	660	108.97 ± 10.98		
Diastolic blood pressure	MetS	660	74.42 ± 9.34	12.86	.000*
	Non-MetS	660	68.27 ± 8.00		

HDL = high-density lipoprotein, LDL = low-density lipoprotein, *t* test.
* $P < .05$.

in comparison with the non-MetS group. It is considered that these differences[48] that are among the diagnostic criteria of MetS may be related with the decrease of nutritional quality.

Consistently with the other studies, the average measurements of body weight, BMI, WC, total numbers of daily step for the MetS group were found to be much higher than the non-MetS group. Unhealthy dietary habits and insufficient PA level cause the increase of body weight, BMI, and WC.[1] The WC is a good indicator of total abdominal fat, whereas abdominal obesity is related with the metabolic abnormality that is formed in the body.[49,50] The WC is recommended to be ≤94 cm for men and ≤80 cm for women by World Health Organization (WHO). As the WC to be >94 cm for men and >80 cm for women indicate the risk of disease, therefore, it is stated that there is a necessity to take measures, while having >102 cm WC for men and >88 cm for women is accepted as the indicator of high risk.[17] Even the individuals in the non-MetS group can be accepted as being under the metabolic disease risk according to their WC in the population of Cyprus accordingly.

A key component of the MetS, central adiposity, is correlated with psychological risk factors associated with coronary artery disease in prior epidemiological studies.[51] MetS, obesity, sedentary lifestyle, and low adherence to Mediterranean diet are often observed in major depression patients and have been separately related with prognosis. It is found that obesity is among the factors that cause depression to increase; however, when MetS exists, the treatment of depression is more difficult.[6] A different study has shown that there is a correlation between the depression and MetS.[52,53] In this study, it is found that the depression score of the individuals having MetS is higher than the group that is non-MetS.

5. Conclusion

In Cyprus, particularly the individuals in the range of 30 to 55 years of age are under the MetS risk due to inactivity. This study shows that active life is a good starting point in terms of preventing the development of MetS. All of the efforts, which are necessary in order to settle awareness of active lifestyle in the community, are required to be materialized by joining the forces of individuals who are trained in this area with the governmental bodies. It can also be added that depression and unbalanced dietary habits are among the most significant factors that cause MetS development in the population of Cyprus. Therefore, it is necessary to increase the knowledge level of the people by developing national PA and nutrition guidelines for the prevention of MetS.

Acknowledgment

The authors would like to thank all volunteers who participated in this study.

Author contributions

Investigation: İsmet Kazaz.
Resources: İsmet Kazaz, Ender Angın, Seray Kabaran.
Methodology: Ender Angın, Seray Kabaran.
Project administration: Ender Angın.
Supervision: Ender Angın, Seray Kabaran.
Writing – original draft: Ender Angın.
Writing – review & editing: Ender Angın, Gözde İyigün, Berkiye Kırmızıgil, Mehtap Malkoç.
Visualization: Mehtap Malkoç.

References

[1] Grundy SM. Metabolic syndrome update. Trends Cardiovasc Med 2016;26:364–73.
[2] Liu J, Grundy SM, Wang W, et al. Ten-year risk of cardiovascular incidence related to diabetes, prediabetes, and the metabolic syndrome. Am Heart J 2007;153:552–8.
[3] Martínez-Larrad MT, Corbatón-Anchuelo A, Fernández-Pérez C, et al. Metabolic syndrome, glucose tolerance categories and the cardiovascular risk in Spanish population. Diabetes Res Clin Pract 2016;114:23–31.
[4] Aguilar M, Bhuket T, Torres S, et al. Prevalence of the metabolic syndrome in the United States, 2003-2012. JAMA 2015;313:1973–4.
[5] Beltrán-Sánchez H, Harhay MO, Harhay MM, et al. Prevalence and trends of metabolic syndrome in the adult US population, 1999–2010. J Am Coll Cardiol 2013;62:697–703.
[6] García-Toro M, Vicens-Pons E, Gili M, et al. Obesity, metabolic syndrome and Mediterranean diet: impact on depression outcome. J Affect Disord 2016;194:105–8.
[7] King WC, Chen J-Y, Courcoulas AP, et al. Objectively-measured sedentary time and cardiometabolic health in adults with severe obesity. Prev Med 2016;84:12–8.
[8] Lopez-Garcia E, Guallar-Castillón P, Garcia-Esquinas E, et al. Metabolically healthy obesity and health-related quality of life: a prospective cohort study. Clin Nutr 2017;36:853–60.
[9] León-Latre M, Moreno-Franco B, Andrés-Esteban EM, et al. Sedentary lifestyle and its relation to cardiovascular risk factors, insulin resistance and inflammatory profile. Rev Esp de Cardiol (Engl Ed) 2014;67:449–55.

[10] World Health OrganizationGlobal Strategy on Diet, Physical Activity and Health. 2004;World Health Organization, Geneva:1–18.
[11] Basciano H, Federico L, Adeli K. Fructose, insulin resistance, and metabolic dyslipidemia. Nutr metab (Lond) 2005;2:5.
[12] Kabaran S, Gezer C, Özer E, et al. Determination of nutritional statues and nutritional intakes of adults who reside in Değirmenlik Area in Turkish Republic of North Cyprus. VIIIth International Nutrition and Dietetics Congress 2012;356–7.
[13] Gezer C, Kabaran S, Özer E, et al. Determination the disease risk of adults according to body mass index and waist circumferences. VIIIth International Nutrition and Dietetics Congress Book 2012;271–2.
[14] Expert Panel on Detection E. Executive summary of the Third Report of the National Cholesterol Education Program (NCEP) expert panel on detection, evaluation, and treatment of high blood cholesterol in adults (Adult Treatment Panel III). JAMA 2001;285:2486.
[15] Available at: www.devplan.org/ISTYILLIK/IST-YILLIK-2015.pdf. Turkish Republic of Northern Cyprus Prime Ministry State Planning Organization, Statistics and Research Department, Nicosia Mersin 10, Turkey. Accessed March 27, 2018.
[16] Bellera CA, Foster BJ, Hanley JA. Calculating sample size in anthropometry. In: Preedy V, ed. Handbook of Anthropometry. Physical Measures of Human Form in Health and Disease. Hardcover. 2012. 3–27.
[17] Higgins PB, Comuzzie AG. In: Preedy V, ed. Measures of waist circumference. Handbook of Anthropometry. Physical Measures of Human Form in Health and Disease. New York, NY: Springer, 2012;881–92.
[18] Craig CL, Marshall AL, Sjöström M, et al. International Physical Activity Questionnaire: 12-country reliability and validity. Med Sci Sports Exerc 2003;35:1381–95.
[19] Saglam M, Arikan H, Savci S, et al. International physical activity questionnaire: reliability and validity of the Turkish version. Perceptual and motor skills 2010;111:278–84.
[20] Bassett D. How many steps/day are enough? Preliminary pedometer indices for public health. Sports Med 2004;34:1–8.
[21] Newby P, Hu FB, Rimm EB, et al. Reproducibility and validity of the Diet Quality Index Revised as assessed by use of a food-frequency questionnaire. Am J Clin Nutr 2003;78:941–9.
[22] Estruch R, Martínez-González MA, Corella D, et al. Effects of a Mediterranean-style diet on cardiovascular risk factors: a randomized trial. Ann Intern Med 2006;145:1–1.
[23] Schröder H, Fitó M, Estruch R, et al. A short screener is valid for assessing Mediterranean diet adherence among older Spanish men and women. J Nutr 2011;141:1140–5.
[24] Beck AT, Ward C, Mendelson M. Beck depression inventory (BDI). Arch Gen Psychiatry 1961;4:561–71.
[25] Hisli N. A study on the validity of Beck Depression Inventory. Turkish J Psychol 1988;6:118–22.
[26] Hunt SM, McKenna S, McEwen J, et al. A quantitative approach to perceived health status: a validation study. J Epidemiol Community Health 1980;34:281–6.
[27] Kücükdeveci A, McKenna S, Kutlay S, et al. The development and psychometric assessment of the Turkish version of the Nottingham Health Profile. Int J Rehabil Res 2000;23:31–8.
[28] Wiley JF, Carrington MJ. A metabolic syndrome severity score: a tool to quantify cardio-metabolic risk factors. Prev Med 2016;88:189–95.
[29] Kwasniewska M, Kaleta D, Dziankowska-Zaborszczyk E, et al. Healthy behaviours, lifestyle patterns and sociodemographic determinants of the metabolic syndrome. Cent Eur J Public Health 2009;17:14–9.
[30] Robinson JG, Ballantyne CM, Hsueh WA, et al. Age, abdominal obesity, and baseline high-sensitivity C-reactive protein are associated with low-density lipoprotein cholesterol, non-high-density lipoprotein cholesterol, and apolipoprotein B responses to ezetimibe/simvastatin and atorvastatin in patients with metabolic syndrome. J Clin Lipidol 2013;7: 292–303.
[31] Pimenta AM, Toledo E, Rodriguez-Diez MC, et al. Dietary indexes, food patterns and incidence of metabolic syndrome in a Mediterranean cohort: the SUN project. Clin Nutr 2015;34:508–14.
[32] Kastorini C-M, Panagiotakos DB, Chrysohoou C, et al. Metabolic syndrome, adherence to the Mediterranean diet and 10-year cardiovascular disease incidence: the ATTICA study. Atherosclerosis 2016;246:87–93.
[33] Blackford K, Jancey J, Lee AH, et al. Home-based lifestyle intervention for rural adults improves metabolic syndrome parameters and cardiovascular risk factors: a randomised controlled trial. Prev Med 2016;89:15–22.
[34] Yoon N-H, Yoo S, Kim H. Composition of metabolic syndrome among Korean adults in a lifestyle modification intervention. Osong Public Health Res Perspect 2014;5:370–7.
[35] Gomez-Huelgas R, Jansen-Chaparro S, Baca-Osorio A, et al. Effects of a long-term lifestyle intervention program with Mediterranean diet and exercise for the management of patients with metabolic syndrome in a primary care setting. Eur J Inter Med 2015;26:317–23.
[36] Kim J, Choi Y-H. Physical activity, dietary vitamin C, and metabolic syndrome in the Korean adults: the Korea National Health and Nutrition Examination Survey 2008 to 2012. Public Health 2016;135:30–7.
[37] Frugé AD, Byrd SH, Fountain BJ, et al. Increased physical activity may be more protective for metabolic syndrome than reduced caloric intake. An analysis of estimated energy balance in US adults: 2007-2010 NHANES. Nutr Metab Cardiovasc Dis 2015;25:535–40.
[38] Petersen CB, Nielsen AJ, Bauman A, et al. Joint association of physical activity in leisure and total sitting time with metabolic syndrome amongst 15,235 Danish adults: a cross-sectional study. Prev Med 2014;69:5–7.
[39] Cocate PG, de Oliveira A, Hermsdorff HH, et al. Benefits and relationship of steps walked per day to cardiometabolic risk factor in Brazilian middle-aged men. J Sci Med Sport 2014;17:283–7.
[40] Newton RL, Han H, Johnson WD, et al. Steps/day and metabolic syndrome in African American adults: the Jackson Heart Study. Prev Med 2013;57:855–9.
[41] Steckhan N, Hohmann C-D, Kessler C, et al. Effects of different dietary approaches on inflammatory markers in patients with metabolic syndrome: a systematic review and meta-analysis. Nutrition 2016; 32:338–48.
[42] Park S, Ahn J, Lee B-K. Very-low-fat diets may be associated with increased risk of metabolic syndrome in the adult population. Clin Nutr 2016;35:1159–67.
[43] Kesse-Guyot E, Ahluwalia N, Lassale C, et al. Adherence to Mediterranean diet reduces the risk of metabolic syndrome: a 6-year prospective study. Nutr Metab Cardiovasc Dis 2013;23:677–83.
[44] Kastorini C-M, Milionis HJ, Esposito K, et al. The effect of Mediterranean diet on metabolic syndrome and its components: a meta-analysis of 50 studies and 534,906 individuals. J Am Coll Cardiol 2011;57:1299–313.
[45] Pitsavos C, Panagiotakos DB, Tzima N, et al. Adherence to the Mediterranean diet is associated with total antioxidant capacity in healthy adults: the ATTICA study. Am J Clin Nutr 2005;82:694–9.
[46] Barbaros B, Kabaran S. Mediterranean diet and health protective properties. J Nutr Diet 2014;42:140–7.
[47] Ros E, Martínez-González MA, Estruch R, et al. Mediterranean diet and cardiovascular health: teachings of the PREDIMED study. Adv Nutr 2014;5:330–6.
[48] Sánchez-Taínta A, Estruch R, Bullo M, et al. Adherence to a Mediterranean-type diet and reduced prevalence of clustered cardiovascular risk factors in a cohort of 3204 high-risk patients. Eur J Cardiovasc Prev Rehabil 2008;15:589–93.
[49] Schröder H. Protective mechanisms of the Mediterranean diet in obesity and type 2 diabetes. J Nutr Biochem 2007;18:149–60.
[50] Pérez-López FR, Chedraui P, Haya J, et al. Effects of the Mediterranean diet on longevity and age-related morbid conditions. Maturitas 2009; 64:67–79.
[51] Janssen I, Katzmarzyk PT, Ross R. Waist circumference and not body mass index explains obesity-related health risk. Am J Clin Nutr 2004;79:379–84.
[52] Després J-P, Lemieux I, Bergeron J, et al. Abdominal obesity and the metabolic syndrome: contribution to global cardiometabolic risk. Arterioscler Thromb Vasc Biol 2008;28:1039–49.
[53] Gurka MJ, Vishnu A, Okereke OI, et al. Depressive symptoms are associated with worsened severity of the metabolic syndrome in African American women independent of lifestyle factors: a consideration of mechanistic links from the Jackson heart study. Psychoneuroendocrinology 2016;68:82–90.