



Trabajo Original

Epidemiología y dietética

Association of Mediterranean diet and anthropometric measures with quality of life in coronary artery disease patients

Asociación de la dieta mediterránea y las medidas antropométricas con la calidad de vida en pacientes con enfermedad arterial coronaria

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Abstract

Introduction: the Mediterranean diet (MD) and ideal body weight are associated with a reduction in the risk of chronic diseases, but their association with health-related quality of life (HRQL) is not clear.

Objective: the aim of this study was to assess the association between adherence to MD and the HRQL and anthropometric measurements in coronary artery disease patients.

Methods: this cross-sectional study was carried out in 55 women and 84 men who were diagnosed with coronary artery disease by a physician. Anthropometric indices were measured, MD adherence was evaluated with a 14-item questionnaire and the 36-Item Short Form Health Survey (SF-36) was used for HRQL.

Results: mean age in males was 63.0 ± 9.7 years and mean age in females was 63.1 ± 10.1 years. Prevalence of overweight and obesity was 53.5% and 40.5%, respectively, in men and 14.5% and 83.6%, respectively, in women. Adherence to the MD was assessed and the median values were found statistically higher in male patients ($p < 0.05$). A significant positive correlation was found between MD and all physical component summary (PCS, its subscale) and most mental component summary (MCS) (except emotional role, social health subscale) ($p < 0.05$). Inverse significant associations were found between BMI, waist circumference, waist/height ratio, percent of body fat and both PCS and MCS (including most subscales).

Conclusion: adoption of healthy dietary habits (adherence to the Mediterranean diet) by the participants and optimal anthropometric measurements may be considered as a possible contributor to HRQL.

Key words:

Cardiovascular disease. Mediterranean diet. Mental health. Physical health. Body composition.

Resumen

Introducción: la dieta mediterránea (DM) y el peso corporal ideal se asocian con una reducción en el riesgo de enfermedades crónicas, pero su asociación con la calidad de vida relacionada con la salud (CVRS) no está clara.

Objetivo: el objetivo de este estudio fue evaluar la asociación entre la adherencia a la DM y la CVRS y las mediciones antropométricas en pacientes con enfermedad arterial coronaria.

Métodos: este estudio transversal se llevó a cabo en 55 mujeres y 84 hombres que fueron diagnosticados con enfermedad de las arterias coronarias por un médico. Se midieron los índices antropométricos, se evaluó la adherencia a la DM con un cuestionario de 14 ítems y se utilizó el cuestionario de salud SF-36 para la CVRS.

Resultados: la edad media de los hombres fue de $63,0 \pm 9,7$ y la edad media de las mujeres fue de $63,1 \pm 10,1$. La prevalencia de sobrepeso y obesidad fue del 53,5% y 40,5%, respectivamente, en hombres y del 14,5% y 83,6%, respectivamente, en mujeres. Se evaluó la adherencia a la DM y los valores de la mediana fueron estadísticamente más altos en los pacientes varones ($p < 0,05$). Se encontró una correlación positiva significativa ($p < 0,05$) entre la DM y el resumen general del componente físico (PCS, subescala) y la mayor parte del resumen del componente mental (MCS), excepto el subpeso emocional y la subescala de salud social. Hubo una correlación negativa entre el IMC, la circunferencia de la cintura, la relación cintura/estatura, el porcentaje de grasa corporal y PCS y MCS (incluida la mayoría de las subescalas).

Conclusión: la adopción de hábitos alimentarios saludables (adherencia a la dieta mediterránea) por parte de los participantes y las mediciones antropométricas óptimas pueden considerarse como un posible contribuyente a la CVRS.

Palabras clave:

Enfermedad cardiovascular. Dieta mediterránea. Salud mental. Salud física. Composición corporal.

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INTRODUCTION

Cardiovascular diseases (CD) are a common cause of mortality and morbidity in the world (1). According to the World Health Organization (WHO) data, an estimated 17.7 million people died from cardiovascular diseases in 2015, representing 31% of all global deaths (2). Evidence shows that dietary and lifestyle factors are the most important determinants of mortality and morbidity among CD (3). Further, unhealthy dietary habits and lifestyles that affect physical and psychosocial health are known as risk factors for the development of life-threatening diseases (4). Several cohort studies have shown that greater adherence to the Mediterranean diet is associated with lower mortality (5,6). Furthermore, few studies have been published about the effect of the diet on the health related quality of life (HRQL) (4,7,8).

Mediterranean diet (MD) has shown a significant beneficial effect on human health over the last 50 years (9). The most common features of the MD include high amount of whole grains, fresh vegetables and fruits, legumes; olive oil as a source of fat; fish, poultry, milk products, eggs and moderate amount of wine and low amount of red meat (10). In a meta-analysis study, greater adherence to the MD was associated with a reduction in metabolic syndrome, type 2 diabetes mellitus (DM), hypertension, heart diseases, systemic and chronic inflammation, risk of cancer and a healthier and a longer life (11-13).

In addition, as the incidence of chronic diseases has increased with globalization, quality of life has been affected negatively (14). The short form of quality of life (SF-36) was reported to be used to evaluate the quality of life as a determinant of medical treatment states and follow-up of the patients (15). There are many studies evaluating the HRQL of participants with cardiovascular diseases and obesity, as well as other chronic diseases (16-18). However, in the literature, there has not been adequate study to evaluate HRQL and Mediterranean diet (4,7,8). The aim of this study was to assess the relationship between MD adherence and HRQL and anthropometric measurements in coronary artery disease patients.

MATERIALS AND METHOD

PARTICIPANTS

This cross-sectional study was carried out in 55 females (over 50 years) and 84 males (over 40 years) who were diagnosed with coronary artery disease in Ankara, Turkey. The patients with a history of coroner artery stenosis (diagnosed by coronary angiography imaging by a cardiologist) were included in the study. The data on the patient demographics (educational level, smoking and alcohol use, coronary artery disease history in the family) was collected through face-to-face interviews by the researchers. Participants were excluded if they reported a personal chronic disease (except type 2 diabetes, dyslipidemia and hypertension); pregnant and lactating women and patients with pacemaker were also excluded. The sampling was performed from February to December 2016. The study procedures were approved by the Ethical Commission of the University of Gazi in meeting number 77082166-604.01.02 (on January 13th, 2016) and

were carried out in accordance with the Declaration of Helsinki (1989) of the World Medical Association. All participants were informed about the aims of the study and provided a written informed consent.

PROCEDURES

Adherence to the Mediterranean diet

Mediterranean diet was assessed with a 14-item questionnaire of Mediterranean diet adherence, which was developed by Schröder et al. in 2011 (19). Each question was scored either 0 or 1 point. The adherence to MD was evaluated after being diagnosed of CAD.

Health-related quality of life

The most commonly used tool to evaluate HRQL is the SF-36 survey. The assessment is based on the last four weeks of the participants. This questionnaire contains 36 items, which consist of eight multi-items including physical function, physical role, pain, general health, emotional role, mental health, social function and vitality. The first four items are considered in the physical health score and the last four items are considered in the mental health score (20). For each parameter, scores are coded, summed and transformed to a scale from 0 to 100. Higher scores suggest better functioning.

ANTHROPOMETRIC MEASUREMENTS, BODY COMPOSITION AND BIOCHEMICAL MEASUREMENTS

Anthropometric measurements (body weight [kg], height [cm], neck [cm], waist and hip circumference [cm]) and body composition of all participants were measured in accordance with the techniques by the WHO (21). Body composition (lean body mass [kg], percent of body fat and body water [%], fat free mass [kg]) was measured through a Tanita® BC 532N. The body mass index (BMI) was calculated through the following formula: $BMI = \text{body weight (kg)} / \text{height (m}^2\text{)}$. Waist/hip and waist/height ratios were also calculated. The BMI values of the participants were classified into three categories according to WHO classification: underweight ($<18.5 \text{ kg/m}^2$), normal weight or healthy ($18.5\text{-}24.9 \text{ kg/m}^2$), overweight ($25.0\text{-}29.9 \text{ kg/m}^2$), and obese ($\geq 30.0 \text{ kg/m}^2$) (25).

Routine biochemical parameters, serum lipid profiles (total cholesterol, LDL, HDL, triglycerides) and fasting blood glucose levels of the participants during the last three months were recorded from the hospital records retrospectively.

STATISTICAL ANALYSIS

Statistical analyses were performed using SPSS 22.0 (Chicago, IL) software. The variables were investigated using visual and analytical methods (Shapiro-Wilk test) to determine whether or not they were

normally distributed. Descriptive values were given as number (n), percent (%), mean (\bar{x}), standard deviation (SD), median and interquartile range (IQR). The continuous variables were not normally distributed (non-parametric tests) and the Mann-Whitney U test was used to compare means. Non-parametric Spearman's rank correlation analysis was performed to determine the relationship between numerical variables. A p-value of less than 0.05 was considered to show a statistically significant result.

RESULTS

The present study included 139 participants, whose mean age was 63.0 ± 9.7 years for males and 63.1 ± 10.1 years for females. Diabetes, dyslipidemia and hypertension incidences were lower in male participants (39.3%, 44.0% and 64.3%, respectively) than in female participants (69.1%, 63.6% and 81.8%, respectively) ($p < 0.05$). Also, 22.6% of all the male participants were smokers *versus* 5.5% of female participants. An educational level longer than eight years was found in 59.5% of male participants and in 10.9% of female participants. Both smoking habits and educational levels were statistically significant according to gender ($p < 0.05$) (data not shown).

Anthropometric measurements and body compositions of participants by gender are given in table I. According to BMI classification, 6.0%, 53.5% and 40.5% of male participants were normal, overweight and obese, respectively; whereas 1.8%, 14.5% and 83.6% of female participants were normal, overweight and obese, respectively (data not shown).

Some biochemical parameters and the MD adherence of participants by gender are shown in table II. Fasting blood glucose, HDL and total cholesterol levels of female participants were found statistically higher than those of male participants ($p < 0.05$). Adherence to the MD was assessed and the median values were found statistically higher in male participants ($p < 0.05$) (Table II).

Physical component summaries (PCS), mental component summaries (MCS) and the subscales of SF-36 of participants by gender subscale are shown in table III. The median values of the component summaries (PCS, MCS), PF, PR, Pain, GH, ER, MH, SH and vitality in the male participants were significantly higher than the female participants ($p < 0.05$).

The correlation between component summaries (physical, mental) and the subscales of the SF-36, adherence to the MD scores and anthropometric measurements-body composition was presented in table IV.

With regard to PCS and antropometric measurements-body composition were not correlated between the groups both male and female (except: waist/height ratio and PCS were correlated in female). In male, PF was found negatively correlated with waist circumference and waist/height ratio. In female, the negative association between the PR and BMI, in addition, pain and waist/height ratio were found. Generally, among subscales of SF-36 and antropometric measurements-body composition significant correlation were found as a unique sample not dividing according to gender. The association between PCS scores, its subscales (except GH and FR), MCS of the participants and waist circumference (cm), BMI (kg/m^2), waist/height ratio and body fat (%) were found negative, whereas a positive significant correlation was found between the aforesaid scores and percent of body water, as well as the fat free mass (kg) ($p < 0.05$) for all participants. A negative correlations were found between ER and waist/height ratio, percent of body fat. MH were negative correlated with BMI, waist/height ratio, percent of body fat ($p < 0.05$). A significant negative correlations were found between SH and waist circumference, BMI, percent of body fat. Vitality scores were negatively correlated with waist circumference, BMI, waist/height ratio and percent of body fat; positively correlated with fat free mass.

When antropometric measurements were assessed by age, gender and educational level, considered to affect the physical

Table I. Anthropometric measurements and body compositions of participants by gender

Anthropometric measurements	Male (n: 84)		Female (n: 55)	
	$\bar{x} \pm S$	Median (IQR)	$\bar{x} \pm S$	Median (IQR)
Height (cm)	166.8 ± 5.8	166.0 (7.0)	151.8 ± 5.2	152.0 (7.0)
Body weight (kg)	83.3 ± 13.1	81.3 (15.9)	81.5 ± 13.4	80.7 (18.6)
Waist circumference (cm)	103.9 ± 9.9	103.0 (13.8)	107.8 ± 30.0	107.5 (18.6)
Hip circumference (cm)	107.5 ± 8.3	106.0 (9.0)	118.3 ± 10.9	118.0 (19.0)
Neck circumference (cm)	41.5 ± 2.8	42.0 (4.3)	38.1 ± 3.6	38.0 (4.5)
Waist/ height ratio	0.62 ± 0.08	0.62 (0.07)	0.71 ± 0.08	0.70 (0.12)
BMI (kg/m^2)	29.9 ± 4.3	29.0 (5.0)	28.3 ± 5.3	34.7 (9.2)
Waist/hip ratio	0.97 ± 0.06	0.96 (0.09)	0.91 ± 0.06	0.92 (0.09)
Body Fat (%)	28.7 ± 6.8	29.2 (7.1)	41.7 ± 6.5	42.5 (7.5)
Body Water (%)	51.0 ± 5.1	50.4 (3.9)	41.3 ± 4.1	40.6 (4.8)
Fat free mass (kg)	55.9 ± 6.3	54.8 (8.3)	44.5 ± 5.1	44.0 (5.8)

BMI: body mass index; IQR: interquartile range.

Table II. Adherence to the Mediterranean diet

Biochemical parameters	Male (n: 84)		Female (n: 55)		p Value
	$\bar{x} \pm S$	Median (IQR)	$\bar{x} \pm S$	Median (IQR)	
Adherence to the MD (0 to 14 points)	7.4 ± 1.7	7.0 (3.0)	6.8 ± 1.4	7.0 (2.0)	0.021*
Fasting blood glucose (mg/dL)	114.7 ± 44.7	104.5 (34.4)	143.7 ± 69.2	124.0 (55.0)	0.001*
HDL (mg/dL)	43.1 ± 11.4	42.6 (10.8)	49.1 ± 15.8	46.5 (14.6)	0.006*
LDL (mg/dL)	110.4 ± 47.6	104.0 (50.9)	120.9 ± 43.8	120.9 (63.0)	0.051
Total cholesterol (mg/dL)	179.5 ± 48.1	178.2 (58.1)	202.8 ± 51.1	202.8 (69.7)	0.003*
Triglyceride (mg/dL)	158.9 ± 114.9	143.7 (83.9)	176.6 ± 90.8	169.6 (69.7)	0.071
VLDL (mg/dL)	31.7 ± 23.0	28.8 (15.6)	34.2 ± 16.7	33.9 (19.8)	0.087

IQR: interquartile range; MD: Mediterranean diet; HDL: high density lipoprotein; LDL: low density lipoprotein; VLDL: very low density lipoprotein. *Significance was calculated with the Mann-Whitney U test for ordinary data analyses participants according to gender expressed median. $p < 0.05$.

Table III. Physical component summaries (PCS), mental component summaries (MCS) and the subscales of SF-36 participants

Components of SF-36	Male (n: 84)		Female (n: 55)		p Value
	$\bar{x} \pm S$	Median (IQR)	$\bar{x} \pm S$	Median (IQR)	
PCS	59.8 ± 18.1	62.2 (27.8)	36.1 ± 16.7	31.9 (18.1)	< 0.001 ^a
PF	72.56 ± 22.18	75.0 (30.0)	39.64 ± 24.28	35.0 (35.0)	< 0.001 ^a
PR	31.25 ± 20.58	37.5 (37.5)	12.50 ± 18.00	0.0 (25.0)	< 0.001 ^a
Pain	72.71 ± 26.01	77.5 (45.0)	44.00 ± 26.18	42.5 (45.0)	< 0.001 ^a
GH	62.50 ± 24.29	70.0 (33.8)	48.27 ± 23.00	50.0 (45.0)	< 0.001 ^a
MCS	58.9 ± 17.3	61.5 (27.2)	39.3 ± 17.80	45.1 (23.5)	< 0.001 ^a
ER	27.38 ± 17.48	33.3 (29.2)	19.70 ± 16.10	16.7 (33.3)	0.010 ^c
MH	68.95 ± 20.44	76.0 (28.0)	53.16 ± 25.68	60.0 (40.0)	< 0.001 ^a
SH	78.57 ± 22.76	87.5 (37.5)	65.68 ± 28.99	75.0 (50.0)	0.010 ^c
Vitality	60.71 ± 24.50	62.5 (35.0)	37.91 ± 23.78	35.0 (30.0)	< 0.001 ^a

IQR: interquartile range; ER: emotional role; GH: general health; MCS: mental component summary; MH: mental health; PCS: physical component summary; PF: physical function; PR: physical role; SH: social health. *Significance was calculated with Mann-Whitney U test for ordinary data analyses of the participants according to gender. p -value: ^a< 0.001; ^b< 0.01; ^c< 0.05.

Table IV. The correlation between component summaries (physical, mental) and the subscales of the SF-36, adherence to the MD scores and anthropometric measurements-body composition

Gender	Parameters	PCS (r)	PF(r)	PR (r)	Pain (r)	GH (r)	MCS (r)	ER (r)	MH (r)	SH (r)	Vitality (r)	MD (r)
Male	Waist circumference (cm)	-0.167	-0.233 ^c	-0.098	-0.091	-0.171	-0.146	-0.096	-0.101	-0.148	-0.192	-0.082
	BMI (kg/m ²)	-0.028	-0.070	-0.007	0.010	-0.036	-0.078	0.008	-0.115	-0.039	-0.146	-0.068
	Waist/height	-0.184	-0.225 ^c	-0.157	-0.069	-0.205	-0.144	-0.109	-0.136	-0.105	-0.178	-0.064
	Body fat (%)	-0.003	-0.082	-0.017	0.097	-0.056	-0.045	0.061	-0.107	0.033	-0.145	-0.059
	Fat free mass (kg)	-0.001	-0.004	0.090	-0.118	0.039	-0.119	-0.021	-0.060	-0.186	-0.136	-0.094
Female	Waist circumference (cm)	-0.234	-0.129	-0.210	-0.259	-0.105	-0.049	-0.034	0.028	-0.085	-0.058	-0.044
	BMI (kg/m ²)	-0.266	-0.129	-0.331 ^c	-0.215	-0.124	-0.086	-0.105	0.097	-0.154	-0.114	-0.087
	Waist/height	-0.286 ^c	-0.226	-0.186	-0.350 ^b	-0.080	-0.099	-0.077	-0.005	-0.112	-0.114	-0.103
	Body fat (%)	-0.057	0.062	-0.260	-0.084	0.005	0.034	-0.171	0.265	-0.116	0.082	0.078
	Fat free mass (kg)	-0.184	0.005	-0.217	-0.058	-0.187	-0.054	0.052	-0.014	-0.101	-0.064	0.002
Total	Waist circumference (cm)	-0.232 ^b	-0.230 ^b	-0.158	-0.205 ^c	-0.185 ^c	-0.171 ^c	-0.120	-0.096	-0.168 ^c	-0.181 ^c	-0.098
	BMI (kg/m ²)	-0.346 ^a	-0.340 ^a	-0.289 ^a	-0.297 ^a	-0.194 ^c	-0.271 ^a	-0.161	-0.190 ^c	-0.172 ^c	-0.324 ^a	-0.154
	Waist/height	-0.442 ^a	-0.440 ^a	-0.335 ^a	-0.386 ^a	-0.290 ^a	-0.330 ^a	-0.227 ^b	-0.249 ^b	-0.216 ^b	-0.361 ^a	-0.169 ^c
	Body fat (%)	-0.375 ^a	-0.392 ^a	-0.343 ^a	-0.297 ^a	-0.215 ^b	-0.271 ^a	-0.172 ^c	-0.190 ^c	-0.146	-0.337 ^a	-0.142
	Fat free mass (kg)	0.362 ^a	0.396 ^a	0.320 ^a	0.285 ^a	0.189 ^c	0.214 ^b	0.166	0.185 ^c	0.076	0.243 ^b	0.097

BMI: body mass index; PCS: physical component summary; PF: physical function; PR: physical role; GH: general health; MCS: mental component summary; ER: emotional role; MH: mental health; SH: social health; MD: Mediterranean diet. The Spearman's rank correlation coefficient test was performed. p -value: ^a< 0.001; ^b< 0.01; ^c< 0.05.

Table V. Association between adherence to the MD and SF-36

SF-36	Adherence to the MD					
	Male		Female		Total	
	r	p-value	r	p-value	r	p-value
PCS	0.182	0.098	0.241	0.077	0.286	0.001 ^a
PF	0.101	0.361	0.318	0.018 ^c	0.261	0.002 ^b
PR	0.108	0.329	0.124	0.366	0.196	0.021 ^c
Pain	0.206	0.060	0.040	0.772	0.237	0.005 ^b
GH	0.156	0.158	0.151	0.270	0.214	0.011 ^c
MCS	0.168	0.018	0.128	0.350	0.216	0.011 ^c
ER	0.018	0.160	-0.029	0.835	0.054	0.525
MH	0.160	0.146	0.269	0.047	0.250	0.003 ^b
SH	0.167	0.128	0.008	0.956	0.144	0.091
Vitality	0.155	0.159	0.139	0.312	0.208	0.014 ^c

PCS: physical component summary; PF: physical function; PR: physical role; GH: general health; MCS: mental component summary; ER: emotional role; MH: mental health; SH: social health. *The Spearman's rank correlation coefficient test was performed. p-value: ^a< 0.001; ^b< 0.01; ^c< 0.05.

component summary, the R² value of the model was 0.46 and it was statistically significant ($p < 0.05$).

The physical health score was found lower especially in female participants ($\beta = -0.504$), low educated participants ($\beta = 0.287$) and the participants with higher neck circumference ($\beta = -0.193$). No correlation was found between HRQL of the participants and biochemical parameters ($p > 0.05$) (data not shown).

The association between adherence to the MD and SF-36 was shown in table V. In terms of gender, the relationship between physical function and adherence to the MD were found only in female participants ($r = 0.261$; $p = 0.018$). Adherence to the MD of the participants was positively correlated with PCS (all subscales) and most MCS (except emotional role, social health subscales) ($p < 0.05$). However, no gender-based association was found ($p > 0.05$). No statistical association was found between adherence to the MD and biochemical parameters either based on gender or not ($p > 0.05$) (data not shown).

DISCUSSION

The relationship between MD and HRQL in the literature has generally been examined in epidemiological studies. However, adherence to the MD can be associated with survival and mortality. Therefore, in this study, the effect of MD on HRQL was examined in patients diagnosed with coronary artery disease.

The MD, in particular, is associated with a reduction in the risk of developing cardiovascular diseases (22). A systematic review reported that MD reduces the risk of cardiovascular disease by 8% to 45% in patients with acute myocardial infarction (23). Another study associated each one-point increase in adherence to the MD with a reduction in myocardial infarction risk by 18% (24). In a study conducted in 110 individuals with cardiovascular disease, the mean score of adherence to the MD was 9.3 (25). In our study, the median value of adherence to the MD score was lower than the aforesaid value by 7.0, both in male and female participants; however, adherence of male individuals was higher ($p < 0.05$). Although

adherence to the MD is generally low, a study conducted in Turkey indicates similar results with this study, with higher adherence to the MD in male individuals (21%) than in female individuals (19%) (26).

To the best of our knowledge, the present study was the first to investigate the associations between adherence to Mediterranean diet (MD), HRQL and anthropometric measurements in the patients with coronary artery disease. One of the key findings of the present study is that a direct linear association was found between adherence to MD and all physical and most mental quality of life. Consistent with this finding, a greater adherence to the MD was associated with better HRQL in cross-sectional studies conducted in Spain and Greece (8,27). Particularly, in a study conducted in Spain (8), a significant direct association was observed between adherence to Mediterranean diet and all the physical and most mental health domains (vitality, social functioning and emotional role). In a Greek study (27), a positive association between adherence to the Mediterranean diet and self-reported mental and physical health status was observed. The association is more obvious for mental than for physical health. By contrast, another study in Spain (28) assessed the association between Mediterranean diet and HRQL in two prospective cohorts of old-age individuals. The UAM-cohort was used to develop an eight-item index of Mediterranean diet (UAM-MDP). The Seniors-ENRICA cohort Mediterranean diet adherence was measured with the PREDIMED score and the Trichopoulou's Mediterranean Diet Score (MSD). In the UAM-cohort, no significant associations between the UAM-MDP and the PCS or the MCS were found. In the Seniors-ENRICA cohort, a higher PREDIMED score was associated with a slightly better PCS, when compared with the lowest tertile of the PREDIMED score. However, the PREDIMED score was non-significantly associated with a better MCS score. The MSD did not show an association with either the PCS or the MCS. The SUN project study concluded that a directly linear association is present between physical-mental health and MD, and this association is particularly stronger in physical health. Thus, the discrepancies between the present study and previous studies in relation to the observed correlations between adherence to MD and HRQL were hypothesized to be due to the consumption of different

food groups, different age groups, population-specific preferences and socioeconomic status. The relation between quality of life and diet was associated with consumption of healthy food or nutrients with lower quantity and mental-physical health. In this study, both low adherence to MD score and the low quality of life scores may explain the correlation between them.

Our study demonstrated that the mean and median value of adherence to the MD score in male was significantly higher (respectively 7.4 ± 1.7 and 7.0 (3.0)) than female (respectively 6.8 ± 1.4 and 7.0 (2.0)) ($p < 0.05$). Although adherence to the MD is generally low, a study conducted in Turkey indicate similar results with this study in terms that higher adherence to the MD in male individuals (21%) than female individuals (19%) (28). Greater adherence to a Mediterranean diet is associated with a significant improvement in health status, as seen by a significant reduction in overall mortality, mortality from cardiovascular diseases (14). A systematic review reported that the MD reduce the risk of cardiovascular disease by 8% to 45% in the patients with acute myocardial infarction (29). Another study associated each increase of one point in adherence to the MD with a reduction in myocardial infarction risk by 18% (30). A study conducted on 110 individuals, aged between 55 and 80 years, who were diagnosed with CAD, the mean score of adherence to the MD (14-items) was found 8.9 (31). Consequently, we can say that little increases adherence to the MD score is a great importance in protection against CAD and quality of life.

Although the effect mechanism remains unclear, another essential component of HRQL is obesity (29). The second objective of this study was to study the association between HRQL and anthropometric measurements-body composition in coronary artery disease patients. In this study, HRQL scores (all subscales) of males were higher than those of females. In females, the higher prevalence of obesity (86%), dyslipidemia, hypertension, diabetes mellitus, median values of some anthropometric measurements (waist circumference, hip circumference, waist to hip circumference, BMI and percentage of body fat) and the lower MD scores can be attributed to the lower HRQL scores in comparison with men. Some studies found a negative association (30) or no association between BMI and mental health scores (31). A meta-analysis study which assessed the BMI and HRQL in adults reported that mental health scores of moderately overweight individuals are significantly higher than those of normal individuals; in addition, third grade obese individuals presented lower mental health scores. The same study found significantly lower physical health scores in individuals with higher BMI values (32). In the PreCIS study, a negative correlation was observed between physical-mental health scores and BMI-waist circumference (15). The majority of the studies associate higher BMI with bad physical function (33). Our data agree with previous findings in that inverse significant associations were found between BMI, waist circumference, waist/height ratio, percent of body fat and both physical and mental health scores (including subscale). Although coronary artery diseases are given as a more important mortality risk for men in the world, the increase in obesity and low educational level negatively affect the physical health components, especially in women, as seen in this study. No correlation was found between HRQL and biochemical parameters ($p > 0.05$). Further, there was no statistical

association between adherence to the MD and biochemical parameters, either based on gender or not ($p > 0.05$) (data not shown). This can be attributed to questioning the short term.

CONCLUSION

In our study, we found that adherence to the MD may be associated with better mental and physical health in the participants with coronary artery disease in Turkish population. Furthermore, a significant association was found between physical and mental health state and anthropometric measurements.

The adoption of healthy dietary habits by the participants is considered as a possible contributor in both improvement of biochemical parameters and achievement of desired results in anthropometric measurements. Moreover, mortality related to coronary artery disease can be significantly reduced in patients highly adhered to MD. Further studies are needed to prove the long term effectiveness of this nutritional regimen in coronary artery disease. The present study outcomes will contribute to new evidence for the health benefits of the MD and may encourage public health policymakers to promote this dietary pattern.

LIMITATIONS

This study has some limitations. It only includes people who are living in central Anatolia, therefore it does not reflect the whole of Turkey. Consequently, further homogeneous and large studies which represent all society are needed. As the population of this study consisted of young consumers from central Turkey, the results cannot be generalized for all coronary artery disease patients or all ages. Performing the study in a large sample of patients would be useful.

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REFERENCES

1. La Verde M, Mulè S, Zappalà G, Privitera G, Maugeri G, Pecore F, et al. Higher adherence to the Mediterranean diet is inversely associated with having hypertension: is low salt intake a mediating factor? *Int J Food Sci Nutr* 2017;1-10. DOI: 10.1080/09637486.2017.1350941
2. World Health Organization (WHO). Cardiovascular diseases. Geneva: WHO; 2017. Available from: <http://www.who.int/mediacentre/factsheets/fs317/en/>
3. Yu E, Rimm E, Qi L, Rexrode K, Albert CM, Sun Q, et al. Diet, lifestyle, biomarkers, genetic factors, and risk of cardiovascular disease in the nurses' health studies. *Am J Public Health* 2016;106:1616-23. DOI: 10.2105/AJPH.2016.303316
4. Ruano-Rodríguez C, Serra-Majem L, Dubois D. Assessing the impact of dietary habits on health-related quality of life requires contextual measurement tools. *Front Pharmacol* 2015;6(101). DOI: 10.3389/fphar.2015.00101

5. Trichopoulou A, Orfanos P, Norat T, Bueno-de-Mesquita B, Ocké MC, Peeters PH, et al. Modified Mediterranean diet and survival: EPIC-elderly prospective cohort study. *BMJ* 2005;330(7498):991. DOI: 10.1136/bmj.38415.644155.8F
6. Martínez-Gómez D, Guallar-Castillón P, León-Muñoz L, López-García E, Rodríguez-Artalejo F. Combined impact of traditional and non-traditional health behaviors on mortality: a national prospective cohort study in Spanish older adults. *BMC Med* 2013;11(1):47. DOI: 10.1186/1741-7015-11-47
7. Muñoz MA, Fito M, Marrugat J, Covas MI, Schröder H. Adherence to the Mediterranean diet is associated with better mental and physical health. *Br J Nutr* 2009;101:1821-7. DOI: 10.1017/S0007114508143598
8. Henríquez Sánchez P, Ruano C, De Irala J, Ruiz-Canela M, Martínez-González MA, Sánchez-Villegas A. Adherence to the Mediterranean diet and quality of life in the SUN Project. *Eur J Clin Nutr* 2012;66:360-8. DOI: 10.1038/ejcn.2011.146
9. Altomare R, Cacciabaudo F, Damiano G, Palumbo VD, Gioviale MC, Bellavia M, et al. The Mediterranean diet: a history of health. *Iranian J Publ Health* 2013;42(5):449-57.
10. Noites A, Pinto J, Freitas CP, Melo C, Albuquerque A, Teixeira M, et al. Effects of the Mediterranean diet and exercise in subjects with coronary artery disease. *Rev Port Cardiol* 2015;34(11):655-64. DOI: 10.1016/j.repc.2015.05.004
11. Grosso G, Mistretta A, Marventano S, Purrello A, Vitaglione P, Calabrese G, et al. Beneficial effects of the Mediterranean diet on metabolic syndrome. *Curr Pharm Des* 2014;20(31):5039-44. DOI: 10.2174/1381612819666131206112144
12. Sofi F, Cesari F, Abbate R, Gensini G, Casini A. Adherence to Mediterranean diet and health status: meta-analysis. *BMJ* 2008;337:a1344. DOI: 10.1136/bmj.a1344
13. Panagiotakos DB, Chrysohoou C, Pitsavos C, Stefanadis C. Association between the prevalence of obesity and adherence to the Mediterranean diet: the ATTICA study. *Nutrition* 2006;22:449-56. DOI: 10.1016/j.nut.2005.11.004
14. Megari K. Quality of life in chronic disease patients. *Health Psychol Res* 2013;1(e27):141-8. DOI: 10.4081/hpr.2013.e27
15. Zhang JP, Pozuelo L, Brennan DM, Hoar B, Hoogwerf BJ. Association of SF-36 with coronary artery disease risk factors and mortality: a PreCIS study. *Prev Cardiol* 2010;13(3):122-9. DOI: 10.1111/j.1751-7141.2009.00061.x
16. González-Chica DA, Dal Grande E, Bowden J, Musker M, Hay P, Stocks N. Are we reducing the risk of cardiovascular disease and improving the quality of life through preventive health care? Results of a population-based study in South Australia. *Prev Med* 2017;99:164-70. DOI: 10.1016/j.ypmed.2017.02.007
17. Bachmann JM, Goggins KM, Nwosu SK, Schildcrout JS, Kripalani S, Wallston KA. Perceived health competence predicts health behaviour and health-related quality of life in patients with cardiovascular disease. *Patient Educ Couns* 2016;99:2071-9. DOI: 10.1016/j.pec.2016.07.020
18. Adriaanse MC, Drewes HW, Van der Heide I, Struijs JN, Baan CA. The impact of comorbid chronic conditions on quality of life in type 2 diabetes. *Qual Life Res* 2016;25:175-82. DOI: 10.1007/s11136-015-1061-0
19. Schröder H, Fitó M, Estruch R, Martínez-González MA, Corella D, Salas-Salvadó J, et al. A short screener is valid for assessing Mediterranean diet adherence among older Spanish men and women. *J Nutr* 2011;141:1140-5. DOI: 10.3945/jn.110.135566
20. De Figueiredo Neto JA, Reis LMCB, Veras MR, Queiroz LLC, Nunes KPLN, Miranda PO, et al. Impact of cardiovascular interventions on the quality of life in the elderly. *Braz J Cardiovasc Surg* 2015;30(6):626-30. DOI: 10.5935/1678-9741.20150080
21. World Health Organization (WHO). Waist circumference and waist-hip ratio: report of a WHO expert consultation. Geneva: WHO; 2008.
22. Kastorini CM, Milionis HJ, Esposito K, Giugliano D, Goudevenos JA, Panagiotakos DB. The effect of Mediterranean diet on metabolic syndrome and its components: a meta-analysis of 50 studies and 534,906 participants. *J Am Coll Cardiol* 2011;57(11):1299-313. DOI: 10.1016/j.jacc.2010.09.073
23. Panagiotakos DB, Pitsavos C, Polychronopoulos E, Chrysohoou C, Zampelas A, Trichopoulou A. Can a Mediterranean diet moderate the development and clinical progression of coronary heart disease? A systematic review. *Med Sci Monit* 2004;10(8):RA193-8. DOI: 10.20960/nh.1670
24. Martínez-González MA, Fernández-Jarne E, Serrano-Martínez M, Wright M, Gómez-Gracia E. Development of a short dietary intake questionnaire for the quantitative estimation of adherence to a cardioprotective Mediterranean diet. *Eur J Clin Nutr* 2004;58(11):1550-2. DOI: 10.1038/sj.ejcn.1602004
25. Ferrer JT, Riera IS, Solórzano MC, Cabré MG, Tapias MG, Masoliver CS. Adherence to the Mediterranean diet in patients with coronary artery disease. *Rev Esp Cardiol* 2015;68(1):70-81. DOI: 10.1016/j.rec.2014.07.023
26. Hoşcan Y, Yiğit F, Müderrisoğlu H. Adherence to Mediterranean diet and its relation with cardiovascular diseases in Turkish population. *Int J Clin Exp Med* 2015;8(2):2860-6.
27. Bonaccio M, Di Castelnuovo A, Bonanni A, Costanzo S, De Lucia F, Pounis G, et al. Adherence to a Mediterranean diet is associated with a better health-related quality of life: a possible role of high dietary antioxidant content. *BMJ Open* 2013;3(8):e003003. DOI: 10.1136/bmjopen-2013-003003
28. Pérez-Tasigchana RF, León-Muñoz LM, López-García E, Banegas JR, Rodríguez-Artalejo F, Guallar-Castillón P. Mediterranean diet and health-related quality of life in two cohorts of community-dwelling older adults. *PLoS One* 2016;11(3):e0151596. DOI: 10.1371/journal.pone.0151596
29. Orpana HM, Berthelot JM, Kaplan MS, Feeny DH, McFarland B, Ross NA. BMI and mortality: results from a national longitudinal study of Canadian adults. *Obesity* 2010;18:214-8. DOI: 10.1038/oby.2009.191
30. Scott KM, Bruffaerts R, Simon GE, Alonso J, Angermeyer M, De Girolamo G, et al. Obesity and mental disorders in the general population: results from the world mental health surveys. *Int J Obes* 2008;32(1):192-200. DOI: 10.1038/sj.ijo.0803701
31. Xu Y, Zhou Z, Li Y, Yang J, Guo X, Gao J, et al. Exploring the nonlinear relationship between body mass index and health-related quality of life among adults: a cross-sectional study in Shaanxi Province, China. *Health Qual Life Outcomes* 2015;13(153). DOI: 10.1186/s12955-015-0347-9
32. Ul-Haq Z, Mackay DF, Fenwick E, Pell JP. Meta-analysis of the association between body mass index and health-related quality of life among adults, assessed by the SF-36. *Obesity* 2013;21(3):E322-7. DOI: 10.1002/oby.20107
33. Fontaine KR, Barofsky I. Obesity and health-related quality of life. *Obes Rev* 2001;2(3):173-82. DOI: 10.1046/j.1467-789x.2001.00032.