Available online at www.medicinescience.org

ORIGINAL ARTICLE

Medicine Science 2022;11(4):1660-7

Medicine Science
International
Medical Journal

The relationship between death risk and nutritional factors in individuals with acute coronary syndrome

Bulent Yaprak[1], Nurgul Arslan[2], Gamze Akbulut[3]

[1]*Malatya Turgut Ozal University, Training and Research Hospital, Department of Internal Medicine, Malatya, Türkiye*
[2]*Dicle University, Ataturk Faculty of Health Sciences, Department of Nutrition and Dietetic, Diyarbakır, Türkiye*
[3]*Gazi University, Faculty of Health Sciences, Department of Nutrition and Dietetic, Ankara, Türkiye*

Received 06 October 2022; Accepted 21 November 2022
Available online 29.11.2022 with doi: 10.5455/medscience.2022.10.215

Abstract

There is a relationship between low food intake and risk of death in patients with acute coronary syndrome. In this study aimed to examine the relationship between The Global Registry of Acute Coronary Events (GRACE risk score) and food intake.: 140 men over 35 years of age with Acute Coronary Syndrome were included in the study. The 1-day energy and nutrient consumption of individuals was determined using a 24-hour food consumption recording method. Based on the GRACE risk score classification system, the patients were divided into four quartiles (89.5≥Q1≥72, 102.5≥Q2≥89.5, 117.75≥Q3≥102.51, 152≥Q4≥117.76). The macro and micronutrient intakes of individuals were compared between the four groups. Nutrient intake decreased in the group with the highest grace risk score. inadequate nutrient intake further increased the GRACE risk score. A negative correlation was found between the GRACE risk score and macro and micronutrients (p<0.05). We found that the increase in the GRACE risk score decreased the food intake otherwise a low level of food intake increased the risk of death.

Keywords: Acute coronary syndrome, death, food intake, GRACE score, nutrition

Introduction

The proportional mortality rate associated with diet has been found to be higher in men than in women, which is consistent with the typically unhealthy eating habits of men [1]. Research on nutrition and health demonstrates the critical role of diet in human life, and the keys to a long and healthy life are sought in adequate and balanced nutrition. The scientific validation of certain nutrients' efficacy in the prevention and treatment of diseases in "natural" ways has raised the importance of nutrition in protecting human health [2]. Studies have found a relationship between the dietary habits of individuals with Acute Coronary Syndrome and their mortality risk [3,4]. The Mediterranean diet reduces inflammation and coagulation indicators, improves endothelial dysfunction and decreases insulin resistance. It has been reported that those following a Mediterranean diet had a lower risk of death from cardiovascular events. A study of healthy Greek adults fed a traditional Mediterranean diet reported a significant reduction in overall mortality and mortality from Acute Coronary Syndrome (ACS) and cancer in those who strictly adhered to the Mediterranean diet [5-7].

One of the few studies examining the relationship between nutritional status and mortality risk in people with acute coronary syndrome is this one. In this study, the relationship between the nutritional status of individuals admitted to the hospital with the diagnosis of ACS and the risk of death was investigated. In this study, nutrient intake and death risk scores of individuals were calculated.

Materials and Methods

Patients and Methods

This study was conducted on 140 male individuals who were diagnosed with Acute Coronary Syndrome over the age of 35 that applied to the Cardiology Service of a tertiary hospital between June and September 2015. The individuals included in the study were selected from volunteer patients and random sampling method was used.

Permission for the study was acquired from the Scientific Committee

***Corresponding Author:** Nurgul Arslan, Dicle University, Ataturk Faculty of Health Sciences, Department of Nutrition and Dietetic, Diyarbakır, Türkiye
E-mail: nuracar_1986@hotmail.com

of the High Specialization Training and Research Hospital, where it would be conducted, with the meeting decision number 332, dated 07/06/2015. Approval of the study was obtained with the decision of Medipol University Ethical Committee meeting with number 108400987, dated 14/07/2015. Each participant was informed about the research and read and signed a written consent form stating that they voluntarily participated in the research. Each stage of the study was conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants before the data collection.

Male individuals over the age of 35 were included in the study. On the other hand, male individuals diagnosed with diseases such as Type I or Type II diabetes and chronic kidney failure (CKF) were excluded from the study.

Informed consent: The data and materials of the current study is available from the corresponding author on reasonable request.

Data Collection and Evaluation

The sociodemographic characteristics (age, marital status, education level) of the individuals diagnosed with ACS and their dietary habits such as the number of main and snack meals, water consumption, and the type of oil (olive oil, sunflower oil, canola oil, corn oil, hazelnut oil, margarine, butter, etc.) used in the meals were questioned within the scope of the study.

Determination of Food and Nutrient Consumption Status of Individuals

The 1-day energy and nutrient consumption of individuals was determined using a 24-hour food consumption recording method. To accurately determine the amount consumed, the 'food and nutrition catalog' food album, which shows the amounts of various foods in different portion sizes in 'grams', was used [8]. The energy and nutritional content of a daily food consumption record were analyzed using the "Computer Aided Nutrition Program, Nutrition Information System" developed for Turkey [9]. The energy and nutrient intakes of individuals were compared to the dietary reference intake (DRI), and the level of fulfillment was classified as enough, adequate, and excessive based on their daily food consumption.

Calculation of the BMI and Death score

In accordance with WHO criteria, those with a body mass index below 18.5kg/m² are underweight individuals, those with 18.5-24.9kg/m² are normal weight individuals, those with a body mass index of 25-29.9kg/m² are slightly obese, 30kg/m² and above were considered as obese individuals [10].

The Global Registry of Acute Coronary Events (GRACE) were calculated by summing the relevant scores for systolic blood pressure, heart rate, age, serum creatinine value, Killip classification, presence of cardiac arrest at the time of admission, ECG, segment change, and cardiac enzyme elevation at the time of hospitalization. A total score of 1-88 indicates "low mortality risk", 89-118 "moderate risk of mortality", and 119-263 "high risk of mortality", respectively [11,12]. In the study, the GRACE risk score of each individual was calculated by a cardiologist (0-6 months mortality score).

Statistical Analysis of Data

Statistical analyses were performed using the SPSS software version 23.0 (IBM SPSS, Chicago, IL). Descriptive statistics are shown as mean±standard deviation for variables with normal distribution, median (lower-upper) for non-normally distributed variables, and number of cases and (%) for nominal variables. While investigating the relationship between continuous variables, Spearman Correlation test was used when the distribution was not normal and Pearson Correlation test was used when it was normal. The results for $p<0.05$ were considered statistically significant. GRACE risk scores are grouped into quartiles ($89.5 \geq Q1 \geq 72$, $102.5 \geq Q2 \geq 89.51$, $117.75 \geq Q3 \geq 102.51$, $152 \geq Q4 \geq 117.76$). The statistical differences between the participants included in the study were analyzed using the GRACE scores. In the study, interpretations were made over the mean and standard deviation for variables with a normal distribution, but over the median and interquartile range (IQR) for variables that did not show normal distribution. In the comparisons between groups, one-way multiple comparison test was used for normally distributed parameters, and interpretations were made on Kruskal Wallis test values for non-normally distributed parameters.

Results

This study was conducted on 140 male individuals who were diagnosed with Acute Coronary Syndrome over the age of 35 who applied to the Cardiology Service of the High Specialized Hospital.

Table 1 summarises the overall characteristics and eating habits of the participants who participated in the study. The mean age and standard deviation of the individuals were determined as 61.4±10.89 years. 100% of the individuals who participated in the study are married, 35% are employed, and 65% are not employed. Of the individuals, 21.4% are skinny, 25% have normal body weight, 32.1% are slightly obese, and 21.4% are obese. 98.6% of individuals eat breakfast, 90% eat lunch, and 98.6% eat dinner, respectively.

The mean, standard deviation, and significance values for energy and nutrient consumption by individuals classified by their GRACE classes are presented in Table 2. According to the GRACE risk score classification, the fibre intakes are statistically different ($p=0.041$). Tukey test findings indicate that there was a difference between Q1 and Q3 ($p=0.039$). There was no statistically significant difference between energy, protein, fat and carbohydrate intakes ($p>0.05$).

The mean and standard deviation of daily fat intake were calculated using GRACE risk score quartiles as 51.29±20.24, 52.3±16.3,52.7±19.2, 46.2±20.7g, respectively. In the second group, the daily cholesterol and polyunsaturated fatty acid intake was determined as 225.1±124.1mg and 10.0±10.5g. Monounsaturated fatty acid intake was determined to be 18.4±8.6g in the third group. The highest intake of saturated fat was found to be 20.3±9.3g in the third group. There was no statistical significance between the groups ($p>0.05$).

Potassium intake was found to be statistically different ($p=0.024$) when analyzed over the GRACE score classification. According to the GRACE scores classification, the mean calcium intake was found to be 638.0±215.0mg in the third group and 549.8±145.2mg in the second group, respectively. According to the GRACE risk score quartiles, the mean phosphorus intake was found to be highest in group Q3 (835.2±196.6mg), and lowest in group Q2 (760.1±190.6mg). Zinc and iron intakes were found to be very close to each other between the groups.

When vitamin B6 intakes were compared according to GRACE risk score quartiles, they were found to be statistically different (p=0.024). Tukey test findings indicated that there was a difference between Q3 and Q4, and that vitamin B6 consumption was low in Q4 (p=0.016). When folic acid intakes were compared according to GRACE risk score quartiles, they were found to be statistically different (p=0.009). Tukey analysis revealed a difference between Q1-Q3 (p=0.017) and Q3-Q4 (p=0.019). The mean intake of vitamin A, beta carotene and vitamin C among the groups was found in the fourth group with the highest GRACE risk score.

The mean, standard deviation and significance values of animal, vegetable proteins and amino acids consumed by individuals on a daily basis according to the GRACE risk score quartiles are shown in Table 3. It was determined that the highest vegetable protein intake was in the Q3 group, whereas the lowest intake was in the Q1 group.

According to the correlation analysis between energy, macro and micro nutrients and the GRACE scores of individuals in Table 4, it is evident that there was a negative correlation between GRACE scores and energy and macronutrients.

Table 1. General characteristics of patients and their eating habits

Demographic characteristics		
Age (Mean ±SD (years))	61.4±10.89	
Working status	n	%
Working	46	35.0
Not working	94	65.0
Education		
Pre-secondary school	105	75.0
Secondary school	24	17.2
Post-secondary school	11	7.8
Current smoker	44	31.4
BMI (Mean ±SD) (kg/cm²)	25.31±6.64(15.06-52.34)	
BMI classification(kg/cm²)		
Thin<18.5	30	21.4
Normal 18.5-24.99	35	25
Overweight 25-29.99	45	32.2
Obese >30	30	21.4
Number of main meals		
3 meals	124	88.5
2 meals	16	11.5
Number of snacks		
No snacks	106	75.7
2 snacks	9	6.4
1 snacks	25	17.9
The habit of making breakfast		
Yes	137	98.6
No	3	1.4
The habit of making lunch		
Yes	129	92.1
No	11	7.9
The habit of having dinner		
Yes	138	98.6
No	2	1.4

SD: Standart deviation, BMI;body mass index

Table 2. The mean, standard deviation and significance values of the energy and macro-micronutrients consumed daily by the patients according to the GRACE risk score quartiles

	Q1	Q2	Q3	Q4			
	$\bar{X}$ ±SS	$\bar{X}$±SS	$\bar{X}$ ±SS	$\bar{X}$ ±SS	F-KW	p	Turkey
Energy(kcal/day)	1221.5±377.85	1273.9±334.01	1329.0±374.27	1152.8±236.83	1.755	0.159	-
Protein(g/day)	52.3±25.53	54.2±18.99	55.1±18.96	46.1±18.44	1.347	0.262	-
Energy from protein (%)	17.4±4.89	17.5±4.45	17.5±5.92	16.1±4.15	2.565	0.464	-
Lipids (g/day)	51.3±20.24	52.3±16.31	52.7±19.23	47.7±15.15	0.560	0.642	-
Energy from Lipids (%)	37.1±7.26	37.0±7.13	35.2±7.40	3.7±7.56	0.499	0.683	-
Carbohydrates (g/day)	134.3±44.41	143.0±45.46	154.8±54.30	132.1±27.0	1.929	0.128	-
Energy from carbohydrate (%)	45.7±8.97	45.5±6.77	47.3±8.88	47.3±7.4	0.530	0.662	-
Fiber(g/day)	11.3±3.80	11.9±4.37	14.5±6.61	13.0±4.90	2.836	0.041*	Q1-Q3
Cholesterol(mg)	219.8±153.47	225.1±124.05	204.8±118.21	161.5±108.76	6.056	0.109	-
MUFAs (g/day)	17.0±7.04	17.3±6.39	18.4±8.62	14.6±4.64	1.888	0.134	-
SFAs (g/day)	19.8±8.25	19.9±6.45	20.3±9.27	17.3±6.61	1.119	0.344	-
PUFAs (g/day)	10.9±7.34	11.2±6.69	10.0±5.58	12.6±6.99	0.878	0.454	-
n-6 PUFAs (g/day)	10.0±7.31	11.0±6.66	9.98±5.58	12.5±7.12	0.890	0.447	-
n-3 PUFAs (g/day)	0.8±0.55	0.9±0.68	0.7±2.33	0.7±0.57	1.136	0.336	-
Calcium (mg/day)	596.4±234.31	549.8±145.23	638.0±214.95	582.7±362.13	4.804	0.187	-
Magnesium(mg/day)	161.7±56.59	16.3±49.37	179.1±50.47	164.5±97.26	5.881	0.118	Q3-Q4
Phosphorus(mg/day)	785.8±292.17	76.1±190.59	835.2±196.63	693.6±265.86	2.087	0.105	-
Iron(mg/day)	6.6±2.68	0.5±2.80	7.5±2.68	7.5±5.71	3.926	0.270	-
Sodium(mg/day)	2348.1±1108.60	2327.1±806.28	2428.1±907.68	2210.7±731.44	0.349	0.790	-
Potassium(mg/day)	1418.3±432.69	1494.8±524.45	1693.1±498.74	1357.9±457.57	3.238	0.024	-
Zinc(mcg/day)	8.3±2.91	8.6±2.85	9.1±3.06	7.9±2.36	0.521	0.669	-
Vitamin A(mcg/day)	514.8±242.46	561.1±280.33	570.21±318.73	619.5±499.68	0.304	0.959	-
Vitamin E (mcg/day)	10.7±6.18	10.9±6.90	11.14±6.34	12.5±6.47	0.548	0.650	-
Vitamin C (mg/day)	38.6±26.55	45.0±33.63	55.77±52.72	45.5±36.57	0.958	0.812	-
Beta Carotene(mcg/day)	1.2±0.82	1.5±1.40	1.60±1.41	1.6±1.17	1.277	0.735	-
Vitamin B1 (mcg/day)	0.5±0.18	0.5±0.17	0.57±0.16	0.5±0.19	5.503	0.138	-
Vitamin B2 (mcg/day)	1.0±0.42	1.0±0.24	1.12±0.29	0.9±0.33	2.030	0.113	-
Vitamin B6 (mcg/day)	0.8±0.32	0.8±0.31	0.93±0.33	0.7±0.25	3.245	0.024*	Q3-Q4
Folic acid (µg/day)	188.4±63.32	212.7±69.37	239.38±95.67	189.2±47.09	4.030	0.009*	Q3-Q1. Q3-Q4

Saturated Fatty Acids (SFAs), Monounsaturated Fatty Acids (MUFAs), Polyunsaturated Fatty Acids (PUFAs)

Table 3. The mean, standard deviation and significance values of animal, vegetable proteins and amino acids consumed daily by the patients according to the GRACE risk score quartiles

	Q1	Q2	Q3	Q4			
	$\bar{X}$ ±SS	$\bar{X}$±SS	$\bar{X}$ ±SS	$\bar{X}$ ±SS	F-KW	p	Turkey
Animal protein (g/day)	34.3±24.16	34.1±16.25	33.1±17.23	26.9±16.72	1.210	0.300	-
Plant protein (g/day)	16.7±5.89	18.7±7.30	21.3±8.46	17.2±5.21	3.246	0.020	-
Sulfur amino acids (SAAs)							
Methionine	109.30±643.94	1124.5±455.97	1117.1±427.42	906.8±450.51	1.481	0.222	-
Cysteine	692.5±358.28	727.6±262.51	744.8±240.57	598.2±235.84	1.931	0.127	-
Branched-Chain Amino Acids (BCAAs)							
Isoleucine	2479.2±1378.55	2507.8±933.39	2573.5±876.62	2105.8±929.51	1.413	0.241	-
Leucine	3975.5±2052.57	4045.2±1431.98	4160.6±1307.32	3403.3±1462.94	1.574	0.198	-
Valine	2689.4±1382.20	2759.7±944.66	2798.3±855.97	2315.7±951.91	1.544	0.205	-
Aromatic amino acids (AAAs)							
Phenylalanine	2250.7±1128.76	2303.1±787.68	2381.3±716.19	1941.9±778.87	1.721	0.165	-
Tyrosine	1799.4±931.43	1803.6±625.13	1866.9±584.99	1515.8±675.80	1.672	0.175	-
Tryptophan	585.1±296.11	594.3±204.94	612.8±190.06	498.1±208.91	1.738	0.162	-

Table 4. Correlation analysis between energy, macro and micronutrients and GRACE scores of patients

	GRACE SCORE	
	r	p
Energy and macronutrients		
Energy	-0.068	0.424
Protein	-0.076	0.371
Lipids	-0.047	0.583
Carbohydrate	-0.042	0.621
Fiber	-0.167*	0.049
Micronutrients		
Calcium	0.036	0.671
Magnesium	0.060	0.483
Phosphorus	-0.080	0.349
Iron	0.110	0.197
Sodium	-0.121	0.153
Potassium	-0.023	0.784
Zinc	-0.056	0.510
Vitamin A	0.070	0.413
Vitamin E	0.126	0.139
Vitamin B1	0.040	0.639
Vitamin B2	-0.056	0.508
Vitamin B6	-0.064	0.451
Vitamin C	0.067	0.432
Folic acid	0.007	0.935
Beta Carotene	0.094	0.267

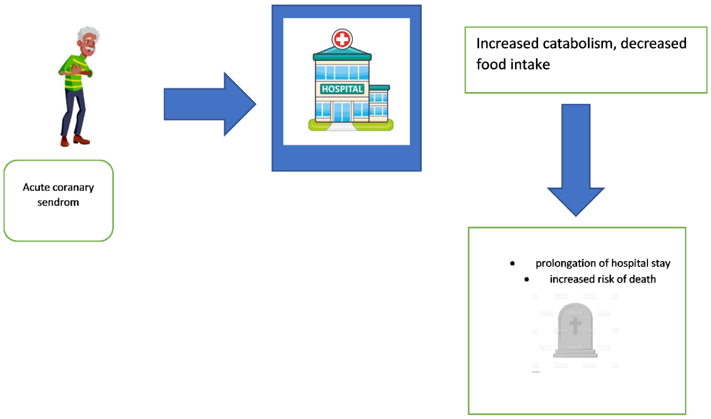

Figure 1. Graphical abstract

Discussion

Age is a significant risk factor for patients with Acute Coronary Syndrome [13]. The risk of developing the disease increases with age. In a large sample size study conducted in Turkey, it was determined that age increases the risk of coronary artery disease by 3.9% in men, regardless of other risk factors [14]. In this study advanced age of this age group can be considered as a risk factor for recurrence of ACS and accompanying symptoms. An inverse relationship between mortality rates and BMI values of individuals with coronary artery disease was found in a meta-analysis research. As a result, it was established that an increased waist circumference increases an individual's mortality risk [15]. It was seen that the distribution was close to each other according to BMI classification. In order to ensure adequate and balanced nutrition, dietary habits such as the number of main meals, the order of meals, and the habit of snacking are critical. In this study, it was observed that the majority of individuals had the habit of having 3 meals every day. Lunch was determined to be the most frequently skipped meal.

Recent studies indicate that calorie restriction without malnutrition may protect against age-related chronic diseases such as obesity, diabetes, hypertension, and cardiovascular disease. In this study, it was observed that daily carbohydrate intake was sufficient in all four GRACE quarter groups, with no statistically significant difference between these groups. In addition, no significant difference was found between daily carbohydrate intake and blood lipids.

It is highlighted that daily protein intake should be balanced between animal and vegetable sources. In this study, the amount of daily protein intake was found to be insufficient in all groups defined by the GRACE quarterly classification of individuals. Individuals are consuming insufficient amounts of meat and meat group nutrients on a daily basis. The average daily protein consumption of participants in the fourth group with the highest GRACE risk score was shown to be the lowest. In this study, it was also observed that individuals with a high GRACE risk score generally had a decreased intake of nutrient diversity.

The role of omega-3 fatty acids in the content of dietary fat in cardiovascular diseases was reported [16, 17]. The biological effects of fish oil include inhibition of hepatic synthesis and secretion of triacylglycerol and very low-density lipoproteins (VLDL-C), as well as reduction in postprandial lipidemia, increase in circulating HDL-C, inhibition of platelet aggregation and prevention of cardiac arrhythmias [18]. In this study, according to the GRACE classification of individuals, the percentage of daily energy intake from fat was found to be higher than the daily intake in all groups. Group 1 with the lowest GRACE risk score has the highest proportion. The high amount of fat consumed in all categories is attributed to the intake of butter and full-fat milk/milk products for breakfast.

Another dietary recommendation is the need of a balanced diet rich in fruits and vegetables and low in saturated fat, cholesterol and sodium. In this study, it was observed that one-day cholesterol intakes were higher than daily intakes in the first, second and third groups. A one-day food consumption record revealed that the amount of saturated fatty acids consumed was highest in the third group. Polyunsaturated fatty acids are in the fourth group with the highest intake. Monounsaturated fatty acids are in the first group with the highest intake. The highest intake of n-3 fatty acids is in the first group with the lowest GRACE risk score. There was no significant correlation between the groups' daily fatty acid intakes. However, considering the disease status of individuals with a high GRACE risk score, it has been reported that olive oil, the best source of monounsaturated fatty acids, should be included in the daily diet due to its beneficial effect on increased inflammation and its ability to increase HDL-C, particularly in these individuals [19].

Phytochemicals such as zeaxanthin, anthocyainidin, flavonones, flavones, and flavonols are advised for a healthy lifestyle because they have been shown to decrease the risk of chronic diseases such as cancer, type 2 diabetes, metabolic syndrome and obesity [20,21]. In this study, daily vegetable consumption of individuals was found to be 65.7%, and fruit consumption was 63.6%. It is recommended that individuals consume fruits and vegetables on a daily basis in order to receive the essential vitamins and minerals.

Soluble fibre, decreases the risk of atherosclerosis, improves poor vascular function, and has a beneficial effect on platelet composition and function in patients with hypercholesterolemia [22]. In this study, the daily fibre intake of individuals was found to be lower than required according to GRACE classifications. When analyzed statistically, a significant relationship was observed between the first and third groups. The reason for this is thought to be due to the low consumption of fibre-rich foods (vegetables, fruits, legumes, etc.).

Vitamin C is an antioxidant vitamin that helps prevent anemia by improving the entry of iron and folic acid into the bloodstream and enhancing their utilization. As a result, it has been found that a vitamin C-rich diet helps prevent a variety of diseases and is a critical nutrient in the development of atherosclerosis [23]. Apart from its beneficial effects on skin cell renewal, vitamin E is effective in preventing cardiovascular diseases [24]. Consumption of palm oil, which is high in tocotriones, is stated to prevent thrombosis in the blood, that is, it creates an antithrombotic effect. In Japan, it has been reported that taking 100 mg of alphatocopherol daily reduced the risk of heart disease [25]. Another study found that this vitamin reduced the chance of death from heart disease by 32%. Additionally, it has been observed that while supplementation with vitamin E may reduce the amount of oxidized LDL-C, it has no significant effect on the risk of MI or mortality [26]. Thiamine is an excellent anti-cancer vitamin. In this study, it was observed that thiamine, riboflavin, niacin and folic acid, which are group B vitamins, are below the required daily intake.

Beta-carotene, the precursor of vitamin A, is stated to have significant efficacy in heart attacks, ischemia and reperfusion [27]. In the Rotterdam study conducted with 108 patients and a control group, it was reported that the incidence of aortic atherosclerosis decreased significantly with increasing dietary lycopene intake [28]. Pyridoxine, cobalamin and folic acid have all been demonstrated to play a protective role against CHD [29]. Niacin is a B group vitamin used in the treatment of high cholesterol and heart disease [30,31]. In this study, it was observed that the majority of the participants in the study generally consumed bread and cereal products. It has been determined that all individuals consume less vitamin A, E and C than the daily required amount. It is thought to be due to insufficient consumption of vegetables and fruits, which are the main sources of vitamins A, E and C.

In a study, an inverse relationship was found between 24-hour urinary sodium excretion and the frequency of MI in a large sample group of patients receiving antihypertensive treatment [32]. There is evidence that a potassium-rich diet has an inverse relationship with the frequency and degree of hypertension. In this study, it was concluded that daily dietary potassium intake was below the recommended daily dose in all GRACE risk classes. Consumption of vegetables and fruits, in particular, was found to be quite low in this study.

A diet low in zinc and low serum zinc levels have been reported to be positively associated with the prevalence of CAD and diabetes [33]. In this study, the average daily intake of calcium, magnesium, and iron was determined to be below the recommended daily intake based on the GRACE risk groups. The reason for insufficient intake of calcium is due to insufficient consumption of milk and dairy products, which are excellent sources of calcium and should be consumed daily. It is thought that the deficit of magnesium, Zn and Fe is due to the fact that white meat is consumed more compared to red meat and eggs. It has been observed that the amount of phosphorus is at the level of recommended daily intake values. No significant difference was observed between the groups in terms of GRACE risk groups.

Branched-chain amino acids have been shown to increase insulin resistance and have a negative effect on blood pressure [34]. In this study, those with higher serum plasma branched-chain amino acids levels were found to have more stenosis in their coronary capillaries. In this study, the amounts of amino acids consumed daily was determined based on the individuals' GRACE risk score quartiles. For amino acid intake, there was no statistically significant correlation between quartiles. However, it is underlined that these essential amino acids should be consumed at specific doses on a daily basis.

Conclusion

Food intake decreased in patients diagnosed with acute coronary syndrome. Low food intake increases the risk of death. In acute coronary syndrome, there is an increased state of catabolism after MI. Low food intake leads to worsening of the situation. In this study, it was observed that the food intake of individuals was very low. A relationship was found between low food and nutrient intake and risk of death.

Conflict of interests
The authors declare that there is no conflict of interest in the study.

Financial Disclosure
This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethical approval
Ethics Committee Approval of the study was obtained. Each participant was informed about the research and read and signed a written consent form stating that they voluntarily participated in the research. Each stage of the study was conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants before the data collection. Medipol Universty Ethic Commitee accept this study.

References

1. Micha R, Peñalvo JL, Cudhea F, et al. Association Between Dietary Factors and Mortality From Heart Disease, Stroke, and Type 2 Diabetes in the United States. JAMA. 2017;317:912-24.
2. Bryan NS. Functional nitric oxide nutrition to combat cardiovascular disease. Cur Ather Rep. 2018;20:1-12.
3. Ravera A, Carubelli V, Sciatti E, et al. Nutrition and cardiovascular disease: finding the perfect recipe for cardiovascular health. Nut. 2016;8:363.
4. Brandhorst S, Longo VD. Dietary restrictions and nutrition in the prevention and treatment of cardiovascular disease. Cir Res. 2019;124:952-65.
5. Becerra-Tomás N, Blanco Mejía S, Viguiliouk E, et al. Mediterranean diet, cardiovascular disease and mortality in diabetes: A systematic review and meta-analysis of prospective cohort studies and randomized clinical trials. Cri Revi In Sci And Nutri. 2020;60:1207-27.
6. Minelli P, Montinari MR. The Mediterranean diet and cardioprotection: historical overview and current research. J Mult Health. 2019;12:805.
7. Arslan N, Ceylan JA, Hatipoğlu A. The relationship of fast food consumption with sociodemographic factors, body mass index and dietary habits among university students. Nutri Fo Sci. 2022;(ahead-of-print).
8. Rakıcıoğlu N, Tek Acar N, Ayaz A, Pekcan G. Food and Nutrition Photo Catalog: dimensions and quantities. 6th edit. Ankara: Ata Ofset Typography. 2016
9. Dehne LI, Klemm C, Henseler G, Hermann-Kunz E. The German food code and nutrient data base (BLS II. 2). Eur J Epidemiol. 1999;15:355-8.
10. Huxley R, Mendis S, Zheleznyakov E, et al. Body mass index, waist circumference and waist: hip ratio as predictors of cardiovascular risk—a review of the literature. Eur J Clin Nutri. 2010;64:16-22.
11. Elbarouni B, Goodman SG, Yan RT, et al. Validation of the Global Registry of Acute Coronary Event (GRACE) risk score for in-hospital mortality in patients with acute coronary syndrome in Canada. Am Heart J. 2009;158:392-9.
12. Tang EW, Wong C-K, Herbison P. Global Registry of Acute Coronary Events (GRACE) hospital discharge risk score accurately predicts long-term mortality post acute coronary syndrome. Am Heart J. 2007;153:29-35.
13. Alatas H, Yildiran H, Yalcin A. The relationship between food intake and malnutrition inflammation score in patients receiving hemodialysis treatment. Cukurova Medical Journal. 2021;2:418-29.
14. Onat A, Ademoğlu E, Can G, et al. Lower circulating migration inhibitory factor protein is associated with metabolic syndrome and diabetes. Biomark Med. 2017;11:557-68.
15. Martins A, Ribeiro S, Gonçalves P, Correia A. Role of central obesity in risk stratification after an acute coronary event: Does central obesity add prognostic value to the Global Registry of Acute Coronary Events (GRACE) risk score in patients with acute coronary syndrome? Rev Port de Cardi. 2013;32:769-76.
16. Linton MF, Yancey PG, Davies SS, et al. The role of lipids and lipoproteins in atherosclerosis. Endotext [Internet]. 2019
17. Ahotupa M. Oxidized lipoprotein lipids and atherosclerosis. Fre Radi Res.

2017;51:439-47.

18. Summerhill VI, Grechko AV, Yet S-F, et al. The atherogenic role of circulating modified lipids in atherosclerosis. Int J Mol Sci. 2019;20:3561.

19. Patel H, Chandra S, Alexander S, et al. Plant-based nutrition: An essential component of cardiovascular disease prevention and management. Cur Cardio Rep. 2017;19:1-10.

20. de Jesus JM, Kahan S, Eckel RH. Nutrition interventions for cardiovascular disease. Med Cli. 2016;100:1251-64.

21. Getz GS, Reardon CA. Nutrition and cardiovascular disease. Arterioscler Thromb Vasc Biol. 2007;27:2499-506.

22. Adair KE, Padgett RN, von Waaden N, et al. Metabolic health, obesity, and cardiovascular disease: 2015–2016 national health and nutrition examination survey. Am J Med Sci. 2021;361:244-52.

23. Houston M. The role of noninvasive cardiovascular testing, applied clinical nutrition and nutritional supplements in the prevention and treatment of coronary heart disease. Ther Adv Cardiovasc Dis. 2018;12:85-108.

24. Godala M, Materek-Kuśmierkiewicz I, Moczulski D,et al. The risk of plasma vitamin A, C, E and D deficiency in patients with metabolic syndrome: a case-control study. Clin Exp Med. 2017;26:581-6.

25. Mathur P, Ding Z, Saldeen T, Mehta JL. Tocopherols in the prevention and treatment of atherosclerosis and related cardiovascular disease. Clin cardio. 2015;38:570-6.

26. Siti HN, Kamisah Y, Kamsiah J. The role of oxidative stress, antioxidants and vascular inflammation in cardiovascular disease (a review). Vas pharm. 2015;71:40-56.

27. Di Pietro N, Di Tomo P, Pandolfi A. Carotenoids in cardiovascular disease prevention. JSM Atheros. 2016;1:1002.

28. Voortman T, Chen Z, Girschik C, et al. Associations between macronutrient intake and coronary heart disease (CHD): The Rotterdam Study. Clin Nutri. 2021;40:5494-9.

29. Pertiwi D, Yaswir R. Correlation of homocysteine levels with folate acid, cyanocobalamine, and pyridoxine serum levels in acute infark miocard patients. IOP Conference Series: Env Sci; 2019. IOP Publishing; p. (vol. 217 no. 1).

30. Bonnefont-Rousselot D. Resveratrol and cardiovascular diseases. Nutri. 2016;8:250.

31. Gromova O, Torshin IY, Nazarenko A, Kalachev A. Deficiency of magnesium and pyridoxine as a risk factors for coronary heart disease. Kardio. 2016;56:55-62.

32. O'Donnell M, Mente A, Yusuf S. Sodium intake and cardiovascular health. Cir Res. 2015;116:1046-57.

33. Choi S, Liu X, Pan Z. Zinc deficiency and cellular oxidative stress: prognostic implications in cardiovascular diseases. Acta Pharmacol Sin. 2018;39:1120-32.

34. Ruiz-Canela M, Toledo E, Clish CB, et al. Plasma branched-chain amino acids and incident cardiovascular disease in the PREDIMED trial. Cli Chem. 2016;62:582-92.