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**ORIGINAL ARTICLE**

# The relationship between results of coronary angiography, Mediterranean-type lifestyle, type D personality, and healthy life expectancy

*Relación entre los resultados de la angiografía coronaria intervencionista, el estilo de vida mediterráneo, los rasgos de personalidad tipo D y la expectativa de vida libre de enfermedad*

*Füsun Afşar[1]\*, Ahmet Güler[2], and Habip Yılmaz[3]*

[1]Department of Cardiology, Dr. Siyami Ersek Thoracic and Cardiovascular Surgery Training and Research Hospital; [2]Department of Cardiology, Istanbul Başakşehir Çam and Sakura City Hospital, University of Health Sciences; [3]Department of Management, Istanbul 1st Region Public Hospitals Presidency. Istanbul, Turkey

## Abstract

**Aim:** *The aim of this study was to determine the relationship between coronary angiography results and Mediterranean-type lifestyle and type D personality.* **Methods:** *Mediterranean-type lifestyle index and type D personality scale were administered to 230 participants.* **Results:** *In univariate analysis according to coronary angiography results, a statistically significant effect was determined between the decision for treatment with percutaneous coronary intervention (PCI) and diabetes mellitus, and total and subscale points of Mediterranean lifestyle index, and between the decision for treatment with bypass and body mass index, Mediterranean diet, physical activity, and total points. In multivariate analysis, there was determined to be an effect between the PCI and systolic pressure, and between bypass and body mass index and subscale of physical activity. When disease-free life expectancy was examined, there was seen to be a negative effect of smoking and low Mediterranean diet points for participants with PCI, and of smoking, presence of hypertension, family history, and high type D personal characteristics score for those with bypass decision.* **Conclusion:** *The evidence-based recommendations for a Mediterranean-type lifestyle stated in cardiovascular disease (CVD) preventative guidelines may have a positive effect on the prevention of CVD, disability-free life, and mortality.*

*Keywords: Coronary angiography. Mediterranean. Lifestyle behaviors. Personality characteristics. Healthy expectancy.*

## Resumen

**Objetivo:** *Este estudio se llevó a cabo para determinar la relación entre los resultados la angiografía coronaria y el estilo vida mediterráneo y los rasgos personalidad tipo D.* **Método:** *El índice de estilo de vida de tipo mediterráneo y la escala de personalidad de tipo D se administraron a 230 participantes* **Resultados:** *Según el resultado angiografía coronaria, subdimensiones intervención coronaria percutánea y diabetes y estilo de vida mediterráneo y puntajes totales en análisis univariante, circunvalación, cuanto a índice masa corporal, dieta estilo mediterráneo, actividad física y puntuación total; en análisis multivariado, se encontró que la intervención coronaria percutánea se asoció con la presión arterial sistólica, circunvalación con el índice masa corporal y subdimensión actividad física. Mirando la esperanza vida libre enfermedades, el tabaquismo y la baja puntuación la dieta tipo mediterránea del participante para el que se tomó la intervención coronaria percutánea, el índice masa corporal bajo, tabaquismo, hipertensión, los antecedentes familiares y los rasgos de personalidad tipo D altos del participante con la circunvalación afectan negativamente la esperanza de vida libre enfermedades.* **Conclusión:** *Como se indica en las*

*pautas de prevención enfermedades cardiovasculares, el estilo vida mediterráneo puede tener efectos positivos en la prevención enfermedades cardiovasculares, discapacidad y mortalidad.*

**Palabras clave**: *Angiografía coronaria. Mediterráneo. Estilo de vida. Características de personalidad. Expectativa de vida.*

# Introduction

According to the 2018 global disease burden report, cardiovascular disease (CVD) was the cause of an estimated 17.8 million deaths worldwide in 2017, and this number constituted 31% of all deaths[1]. The development and prognosis of CVD have been strongly associated with nutritional habits and lifestyle. In the globally accepted cardiac health guidelines, a reduction in saturated fats and trans-fatty acids is recommended as an important protective factor, and it has been emphasized that there is a strong relationship between a healthy diet and lifestyle, and a reduction in the incidence of CVD.

Studies in recent years have shown a significant reduction in CVD risk in individuals with a Mediterranean-type diet. The potential effect mechanisms of a Mediterranean-type lifestyle include protection against oxidative stress, inflammation and thrombocyte aggregation, modification of hormones and growth factors, inhibition of nutrient perception pathways with specific amino acid restriction, the intestinal microbiota-mediated production of metabolites that affect metabolic health, and the high beneficial effects on these biomarkers at the start of atherosclerosis[2]. An increase in adherence to a healthy lifestyle determined by combinations of adherence to a Mediterranean diet, physical activity, smoking, and alcohol consumption has been found to be associated with a decrease of > 50% in mortality for all these reasons[3]. A healthy lifestyle has been associated with a 66% risk reduction for CVD, a 60% decrease in stroke, and a 69% decrease in heart failure[4].

In protective cardiac health guidelines, Mediterranean lifestyle cardiovascular risk factors have also been associated with lower mortality. The personal characteristics and lifestyle of an individual are important determinants of health status. A series of studies have found that type D personality is an independent predictor of cardiac events following percutaneous coronary intervention (PCI). To determine the personality traits of a group of heart patients, the type D personality scale was developed by Denollet, and its validity and reliability were performed in many countries[5,6]. While a Mediterranean lifestyle is a model of healthy living contributing to health status, there are ongoing studies that type D personal characteristics may be a risk factor in the formation of coronary diseases[7]. Intravascular imaging is the most valuable method to determine the treatment process in detecting lesions and fragility markers in patients presenting with CVD. The aim of this study was to determine the relationship between coronary angiography results and a Mediterranean-type lifestyle and type D personality characteristics.

## Methods

The study was conducted with face-to-face interviews of all the patients who underwent coronary angiography in an A1-level Specialism Training and Research Hospital. It was calculated to be necessary to include 207 patients F-test family used 0.90 power, 0.05 error, 0.25 effect size. Demographic data were recorded and the Mediterranean-type lifestyle index and type D personality scale were applied to all the participants[8]. Mediterranean-type lifestyle index (MEDLIFE) is a 28-item derived index consisting of questions about food consumption (fifteen items), traditional Mediterranean dietary habits (seven items) and physical activity, and rest and social interaction habits (six items). Participants who report that they do not consume the Mediterranean lifestyle index are given 0 points, and participants who do consume 1–points.

Type D personality scale comprises seven items each for the negative affectivity and social inhibition subscales. Examples of the items are "I often feel unhappy" (NA) and "I feel inhibited in social interactions" (SI). The items are rated on a 5-point Likert scale from 0 (*false*) to 4 (*true*)[5,8].

In the statistical analyses, G*Power 3.1.9.4, RStudio version 2022.02.1, and IBM SPSS vn. 22.0 software were used. When evaluating the data was used with frequency tables, Shapiro-Wilk test (for normality), differences were with the Kruskal-Wallis H test, Mann-Whitney U-test (with Bonferroni correction), univariate/multivariate logistic regression analysis for risk factors, and effect of age with Cox regression analysis.

A descriptive statistical analysis and univariate/multivariate logistic regression model for risk factors were performed.

**Table 1. Distribution of the demographic data of the patients according the coronary angiography results**

| Angio result | Medical treatment | | PCI | | Bypass | | p* |
|---|---|---|---|---|---|---|---|
| | Mean ± SD | Kurtosis; skewness | Mean ± SD | Kurtosis; skewness | Mean ± SD | Kurtosis; skewness | |
| Age (years) | 57.79 ± 9.59 | 1.26; −0.35 | 58.96 ± 11.45 | 6.95; −1.66 | 64.61 ± 6.95 | −1.12; −0.04 | 0.0001[†] |
| Weight (kg) | 80.07 ± 13.7 | −0.29; 0.18 | 83.54 ± 12.44 | 0.02; 0.17 | 77.03 ± 12.64 | −0.95; −0.25 | 0.028[†] |
| Height (cm) | 165.98 ± 9.22 | 0.55; 0.13 | 167.83 ± 8.78 | −0.46; −0.06 | 167.21 ± 8.49 | 0.3; 0.23 | 0.469 |
| BMI | 29.15 ± 5.19 | 2.24; 1.18 | 29.74 ± 4.58 | 1.17; 0.84 | 27.52 ± 3.84 | −0.77; −0.55 | 0.069 |
| SBP | 138.02 ± 16.5 | 0.69; 0.57 | 142.14 ± 13.23 | −0.09; 0.37 | 145.41 ± 15.94 | −1.4; 0.18 | 0.025[†] |
| DBP | 80.94 ± 10.14 | −0.15; −0.51 | 81.01 ± 8.21 | −0.25; −0.34 | 82.56 ± 14.01 | −0.96; 0.18 | 0.764 |

*Kruskal-Wallis H test.
[†]p < 0.05 statistically significant.
BMI: body mass index; SBP: systolic blood pressure; DBP: diastolic blood pressure.

**Table 2. Distribution of the type D personality characteristics and Mediterranean-type lifestyle index according to the coronary angiography results**

| Angio result | Medical treatment | | PCI | | Bypass | | p* |
|---|---|---|---|---|---|---|---|
| | Mean ± SD | Kurtosis; skewness | Mean ± SD | Kurtosis; skewness | Mean ± SD | Kurtosis; skewness | |
| Consumption of food | 11.21 ± 2.82 | −0.67; −0.43 | 9.8 ± 3.29 | 1.73; −1.13 | 9.24 ± 2.5 | 1.18; −0.47 | 0.000[1,2‡] |
| Diet ability | 6.33 ± 1.56 | 0.55; −1.02 | 5.3 ± 2.06 | −0.65; −0.5 | 5.93 ± 1.83 | 0.58; −1.14 | 0.003[1‡] |
| Physical activity | 5.67 ± 1.73 | −0.74; −0.34 | 4.73 ± 2.01 | −0.77; −0.25 | 4.12 ± 2.11 | −0.9; −0.44 | 0.0001[1,2‡] |
| Total | 23.21 ± 5.05 | −0.73; −0.23 | 19.83 ± 5.84 | 0.58; −0.94 | 19.29 ± 3.96 | 0.88; −0.38 | 0.0001[1,2‡] |
| D type personality | 21.15 ± 8.19 | 0.78; 0.72 | 21.63 ± 9.34 | −0.31; 0.43 | 21.08 ± 6.94 | 0.9; 0.57 | 0.979 |

*Kruskal–Wallis H test.
[†]p < 0.05 statistically significant.
[‡]Mann-Whitney U-test.
1: Medical treatment versus PCI.
2: Medical treatment versus bypass.
BMI: body mass index; SBP: systolic blood pressure.

### *Ethical approval*

The study was carried out with the permission of the Health Sciences Hospital Clinical Research Ethics Committee (decision no: KAEK/2022.07.231). Written informed consent was obtained from all the study participants.

## Results

The patients were examined in three different categories according to the coronary angiography results. The treatment decisions were made of medical treatment for 84 (36%) patients, PCI for 71 (31%), and a bypass procedure for 75 (33%).

The mean age of the patients was determined to be 60.37 ± 9.99 years (46-79), body mass index (BMI) was 28.80 ± 4.67 (19.53-46.06), and systolic blood pressure was 141.70 ± 15.62 (100-188). In all three groups, BMI was in the range of 25-30 (overweight) and systolic blood pressure was > 135 mmHg. A statistically significant difference was determined between the medical treatment and the bypass group in respect of systolic blood pressure (p < 0.0001), and age (p = 0.012) (Table 1).

The bypass group patients were determined to have statistically significantly lower subscale and total points in the MEDLIFE compared to the other groups (p < 0.05). Consumption of food was statistically significantly higher at 11.21 ± 2.82 in the medical treatment group, compared to 9.80 ± 3.29 in the PCI group and 9.24 ± 2.50 in the bypass group (p = 0.006, p < 0.0001) (Table 2).

For the patients consuming Mediterranean-type food, the decision was made for medical treatment as a result of the coronary angiography. The diet ability was recorded as 6.33 ± 1.56 for the medical treatment

**Table 3. The effect of Mediterranean-type lifestyle and type D personality characteristics on the patients in the medical treatment and PCI groups**

| Angio medical and PCI | Univariate* | | | | Multivariate† | | | |
|---|---|---|---|---|---|---|---|---|
| | p | Exp (B) | 95% C.I. for EXP (B) | | p | Exp (B) | 95% C.I. for EXP (B) | |
| | | | Lower | Upper | | | Lower | Upper |
| Age | 0.487 | (+) 1.011 | 0.980 | 1.043 | 0.544 | (+) 0.988 | 0.950 | 1.027 |
| BMI | 0.454 | (+) 1.025 | 0.961 | 1.094 | 0.456 | (+) 1.028 | 0.956 | 1.106 |
| Systolic BP | 0.095 | (+) 1.018 | 0.997 | 1.041 | 0.027‡ | (+) 1.034 | 1.004 | 1.064 |
| Smoking | 0.332 | (+) 0.834 | 0.578 | 1.204 | 0.978 | (+) 1.006 | 0.649 | 1.559 |
| Family history | 0.129 | (+) 0.734 | 0.493 | 1.094 | 0.606 | (+) 0.885 | 0.557 | 1.407 |
| DM | 0.030‡ | (+) 0.697 | 0.504 | 0.965 | 0.061 | (+) 0.692 | 0.471 | 1.017 |
| HT | 0.548 | (+) 1.103 | 0.802 | 1.516 | 0.084 | (+) 1.445 | 0.951 | 2.195 |
| Consumption of food | 0.006‡ | (−) 0.857 | 0.766 | 0.957 | 0.618 | (−) 0.961 | 0.823 | 1.123 |
| Diet ability | 0.001‡ | (−) 0.73 | 0.605 | 0.879 | 0.060 | (−) 0.796 | 0.627 | 1.010 |
| Physical activity | 0.003‡ | (−) 0.765 | 0.641 | 0.913 | 0.064 | (−) 0.802 | 0.634 | 1.013 |
| Total | 0.0001‡ | (−) 0.89 | 0.834 | 0.949 | - | - | - | - |
| D type personality | 0.732 | (+) 1.006 | 0.970 | 1.044 | 0.149 | (+) 1.033 | 0.988 | 1.080 |

*Univariate logistic regression analysis.
†Univariate logistic regression analysis p < 0.05.
‡Statistically significant.
BMI: body mass index; SBP: systolic blood pressure; DM: diabetes mellitus.

group, 5.93 ± 1.83 for the bypass group, and 5.3 ± 2.06 for the PCI group, and there was determined to be a statistically significant difference between the medical treatment and PCI groups (p = 0.001). The physical activity subscale points were statistically significantly higher at 11.21 ± 2.82 in the medical treatment group than in the PCI (9.80 ± 3.29) and bypass (9.24 ± 2.50) groups (p = 0.006 and p < 0.0001, respectively). The total points of the MEDLIFE were determined to be statistically significantly higher in the medical treatment group (23.21 ± 5.05) than in the PCI group (21.63 ± 9.34) and the bypass group (21.08 ± 6.94) (p < 0.0001).

The effects of demographic characteristics, MEDLIFE, and type D personality characteristics were investigated in the patients who applied with PCI compared to the patients who received medical treatment, according to the coronary angiography results. As a result of the analysis, it was seen that age, BMI, systolic blood pressure, smoking, family history, diabetes mellitus (DM), and hypertension (HT) increased the decision for PCI, and the statistical significance was determined to be associated with a diagnosis of DM in univariate analysis, and with systolic blood pressure in multivariate analysis (p < 0.05). As both the total and subscale points of the MEDLIFE decreased, so

there was an increase in the decision for PCI, and this was determined to show statistical significance in univariate analysis (p < 0.05) (Table 3).

The effects of demographic characteristics, MEDLIFE, and type D personality characteristics were investigated in the patients applied with bypass compared to the patients who received medical treatment, according to the coronary angiography results. As a result of the analysis, it was seen that age, systolic blood pressure, smoking, family history, the presence of DM, and HT increased the decision for bypass, and the statistical significance was determined to be associated with age, systolic blood pressure, smoking, family history, and a diagnosis of DM in univariate analysis and with age, smoking, and family history in multivariate analysis (p < 0.05). As the BMI and both the total and subscale points of the MEDLIFE decreased, so there was an increase in the decision for bypass, and BMI, Mediterranean-type diet, physical activity, and total points were determined to show statistical significance in univariate analysis, and BMI and the physical activity subscale in multivariate analysis (p < 0.05) (Table 4).

Smoking and low Mediterranean-type diet points of the patients in the PCI group had a negative effect on

**Table 4. The effect of Mediterranean-type lifestyle and type D personality characteristics on the patients in the medical treatment and bypass groups**

| Angio medical versus bypass | Univariate* | | | | Multivariate† | | | |
|---|---|---|---|---|---|---|---|---|
| | p | Exp (B) | 95% C.I. for Exp (B) | | p | Exp (B) | 95% C.I. for Exp (B) | |
| | | | Lower | Upper | | | Lower | Upper |
| Age | 0.0001‡ | (+) 1.105 | 1.058 | 1.155 | 0.0001‡ | (+) 1.139 | 1.065 | 1.219 |
| BMI | 0.031‡ | (−) 0.923 | 0.858 | 0.993 | 0.0001‡ | (−) 0.769 | 0.670 | 0.884 |
| Systolic BP | 0.006‡ | (+) 1.028 | 1.008 | 1.049 | 0.068 | (+) 1.032 | 0.998 | 1.068 |
| Smoking | 0.019‡ | (+) 0.658 | 0.464 | 0.933 | 0.007‡ | (+) 0.496 | 0.298 | 0.827 |
| Family history | 0.0001‡ | (+) 0.47 | 0.324 | 0.682 | 0.028‡ | (+) 0.556 | 0.330 | 0.938 |
| DM | 0.004‡ | (+) 0.627 | 0.454 | 0.865 | 0.120 | (+) 0.678 | 0.415 | 1.107 |
| HT | 0.073 | (+) 0.738 | 0.529 | 1.029 | 0.277 | (+) 0.747 | 0.442 | 1.263 |
| Consumption of food | 0.0001‡ | (−) 0.759 | 0.667 | 0.864 | 0.354 | (−) 0.922 | 0.776 | 1.095 |
| Diet ability | 0.140 | (−) 0.869 | 0.720 | 1.047 | 0.901 | (−) 1.018 | 0.767 | 1.352 |
| Physical activity | 0.0001‡ | (−) 0.661 | 0.550 | 0.794 | 0.042‡ | (−) 0.748 | 0.565 | 0.990 |
| Total | 0.0001‡ | (−) 0.828 | 0.764 | 0.897 | - | - | - | - |
| D type personality | 0.950 | (−) 0.999 | 0.958 | 1.041 | 0.151 | (+) 1.043 | 0.985 | 1.104 |

*Univariate logistic regression analysis.
†Univariate logistic regression analysis p < 0.05.
‡Statistically significant.
BMI: body mass index; SBP: systolic blood pressure; DM: diabetes mellitus.

disease-free life expectancy (p < 0.05) (Fig. 1A). Low BMI, smoking, the presence of HT, family history, and high type D personality characteristics points of the patients in the bypass group had a negative effect on disease-free life expectancy (p < 0.05) (Fig. 1B).

## Discussion

The content of the previous randomized controlled studies, systematic examinations, meta-analyses, and observational studies in respect of the primary prevention of CVDs has focused on subjects such as risk evaluation, diet, exercise/physical activity, obesity and weight loss, type 2 DM, blood cholesterol, HT, stopping smoking, and the use of aspirin. At the core of all these issues, it is stated that atherosclerotic cardiovascular diseases can be prevented only if clinicians can provide individuals with healthy lifestyle behaviors with evidence-based recommendations[9].

The results of the present study showed that the group for whom medical treatment was decided had higher sub-scale and total MEDLIFE points. In a study of 5966 patients showing the relationship between a Mediterranean diet and cardiovascular events, it was shown that adherence to a Mediterranean diet reduced the risk of CVD independently of risk factors[10]. In a pioneering primary prevention study in Spain, which included patients at high cardiovascular risk, a Mediterranean diet was seen to reduce CVD by 30% compared to a low-fat diet[9]. There are also studies showing the relationship of CVD with physical activity in the Mediterranean lifestyle in addition to the Mediterranean diet as evidence-based lifestyle recommendations stated in the CVD prevention guidelines[11]. In studies in Spain, the combined effect of good adherence to a Mediterranean diet with increased physical activity showed positive effects on mortality[12-14]. In a meta-analysis of 45 studies which evaluated four randomized controlled studies and 32 independent observation groups, a Mediterranean diet was seen to be associated with positive cardiovascular health outcomes[15].

In the present study of 230 participants, the BMI value was in the range of 25-30 (overweight) and systolic blood pressure was > 135 mmHg. Despite the strong relationship between obesity and the development of CVD in the previous studies, the results obtained from large meta-analyses have shown that patients with CVD and BMI above the normal range generally have a better prognosis[16]. In a prospective
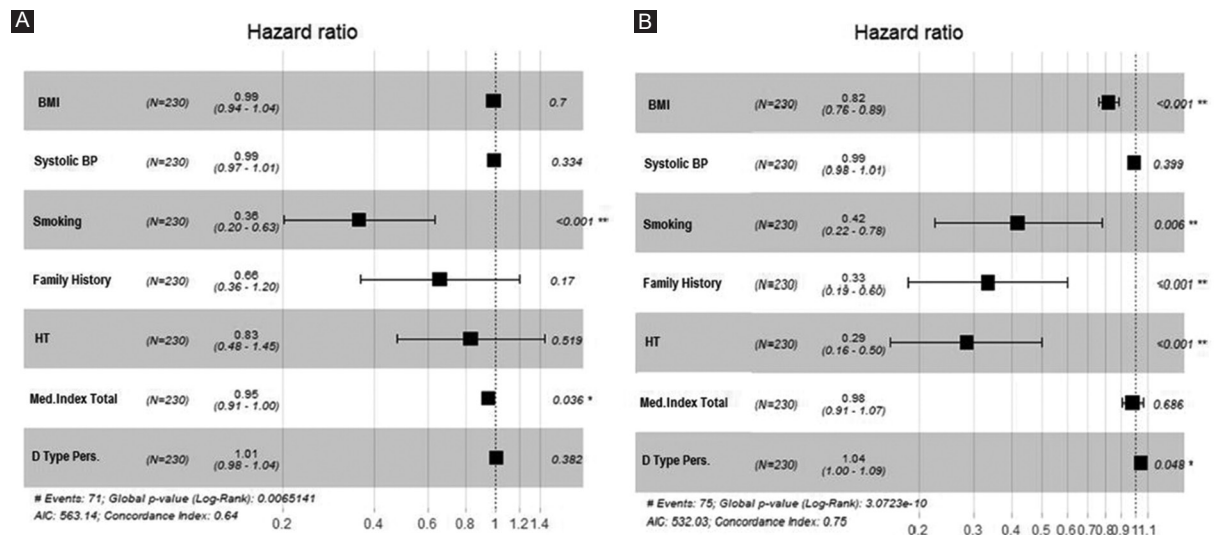
**Figure 1. A:** *disease-free life expectancy in the percutaneous coronary intervention group patients.* **B:** *bypass group patients.*

study that initially included 717 patients, there was no correlation between BMI and major advanced cardiovascular events in 201 patients in a 3.9-year follow-up period, but the percentage of body fat mass showed an effect[17]. In the present study, the BMI of the bypass group patients was determined to be lower than the values of the other two groups. Life expectancy is especially affected in patients with bypass. Consistent with findings in the literature, the systolic blood pressure was also found to be higher in the bypass group of the present study. In the literature related to systolic blood pressure as one of the risk factors for coronary artery disease, a study with 1457 participants reported that for every 10 mmHg increase in systolic blood pressure, there was a 53% higher risk of atherosclerotic CVD[18]. The analysis at the temporary patient level of seven randomized clinical studies which included 3912 patients from 2004 to 2016, there was seen to be a significant step-by-step relationship of increasing quartiles of systolic blood pressure with survival curves, and cumulative major adverse cardiovascular events[19]. The previous studies have shown a relationship between the Mediterranean lifestyle and BMI and systolic blood pressure. When the effects of BMI and diet quality on mortality have been examined independently, it has been determined that individuals with a normal BMI but low Mediterranean diet points have high mortality compared to those with high Mediterranean diet points and obese or normal BMI values, and obese individuals showed a lower increase in cardiovascular mortality[20].

There are several studies in the literature showing a relationship between diabetes and CVD risk, and when there are major adverse cardiovascular events, the negative effects have been stated of several factors related to diabetes such as instant blood glucose, fasting blood glucose, and glycosylated hemoglobin A1c[21,22]. Studies in recent years in particular have been directed at determining the effect and prognosis in major adverse CVDs. It is thought that in the evaluation of major adverse cardiovascular events, the TyG index, independently of known cardiovascular risk factors, will predict future major adverse cardiovascular events in patients with diabetes and acute coronary syndrome and could be a beneficial marker for risk classification and prognosis in patients with the acute coronary syndrome[23-25]. In the present study, a diagnosis of diabetes and MEDLIFE were seen to have a statistically significant effect, especially on the patients who applied with PCI[26].

In addition to the known risk factors in patients who underwent bypass in the present study, type D personality characteristics showed a negative effect on disease-free life expectancy. Although there are few studies in the literature with large samples, it has been emphasized that type D personality characteristics are an important part of the psychosocial risk factors that affect coronary artery disease prognosis. In a meta-analysis of 12 studies including 5341 participants, there was seen to be a significant increase in the mortality risk of coronary artery disease patients with type D personality characteristics[27].

## Conclusion

The results of this study demonstrated a relationship between Mediterranean-type lifestyle, type D personality characteristics, the known risk factors of CVD, and the treatment decision made according to the result of coronary angiography. As an evidence-based lifestyle recommendation stated in the CVDs prevention guidelines, a Mediterranean-type lifestyle may have positive effects on the prevention of CVD, a disability-free life, and mortality. To be able to reach a conclusion about the relationship with type D personality characteristics, there is a need for further studies with larger samples.

## Conflicts of interest

The authors have no conflicts of interest to declare.

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## Ethical disclosures

**Protection of human and animal subjects.** The authors declare that the procedures followed were in accordance with the regulations of the relevant Clinical Research Ethics Committee and with those of the Code of Ethics of the World Medical Association (Declaration of Helsinki).

**Confidentiality of data.** The authors declare that they have followed the protocols of their work center on the publication of patient data.

**Right to privacy and informed consent.** The authors have obtained approval from the Ethics Committee for analysis and publication of routinely acquired clinical data and informed consent was not required for this retrospective observational study.

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