Evaluación de la Relación del Estado Nutricional con Comorbilidades en Individuos con Enfermedad Cardiovascular

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Resumen

Fundamentos: El objetivo del estudio fue evaluar la relación entre el estado nutricional, la calidad de vida y las comorbilidades en individuos con enfermedad cardiovascular**.**
Métodos: El estudio se realizó con 127 pacientes en la consulta de cardiología. Se registraron datos demográficos, se realizaron mediciones antropométricas. Se utilizaron las puntuaciones NRS-2002 y CONUT para determinar el riesgo de desnutrición, el índice de comorbilidad de Charlson (ICC) para evaluar el estado de comorbilidad, la escala de calidad de vida SF-12 para evaluar la calidad de vida**.**
Resultados: El valor medio de CCI de los participantes fue 3,96 ± 1,81, la puntuación CONUT fue 2,31 ± 2,27, la puntuación del componente físico SF-12 fue 34,70 ± 8,97, la puntuación del componente mental fue 39,33 ± 9,56. La puntuación de NRS-2002 se correlacionó positivamente con CCI (r=0,400), la puntuación CONUT (r=0,561) y se correlacionó negativamente con las puntuaciones de los componentes físico (r= 0,502) y mental (r=-0,468) del SF-12. La puntuación del CCI se correlacionó negativamente con las puntuaciones de los componentes físico (r=-0,309) y mental (r=-0,296) del SF-12 (p<0,05). Además, se predijo que un aumento de 1 DE en la puntuación de NRS reduciría las puntuaciones de los componentes físico y mental del SF-12 en 0,185 y 0,215, respectivamente. También se encontró que la puntuación CONUT tenía un efecto negativo sobre el componente físico del SF-12 (p<0,05)**.**
Conclusiones: Se concluyó que el riesgo de desnutrición es alto en individuos con enfermedades cardiovasculares.

Palabras clave: Enfermedad Cardiovascular; Comorbilidad; Puntuación CONUT; Nutrición; Calidad De Vida.

Evaluation of the Relationship of Nutritional Status with Comorbidities in Individuals with Cardiovascular Disease

Summary

Background: The aim of the study was to evaluate the relationship between nutritional status, quality of life and comorbidities in individuals with cardiovascular disease**.**
Methods: he study was carried out with 127 patients in the cardiology clinic. Demographic data were recorded, anthropometric measurements were performed. NRS-2002 and CONUT scores were used to determine the risk of malnutrition, Charlson Comorbidity Index (CCI) was used to evaluate the comorbidity status, SF-12 quality of life scale was used to evaluate the quality of life.
Results: The mean CCI value of the participants was 3.96±1.81, CONUT score was 2.31±2.27, SF-12 physical component score was 34.70±8.97, mental component score was 39.33±9.56. NRS-2002 score was positively correlated with CCI (r=0.400), CONUT score (r=0.561) and negatively correlated with SF-12 physical (r=-0.502), mental (r=-0.468) component scores. CCI score was negatively correlated with both physical (r=-0.309), mental (r=-0.296) component scores of SF-12 (p<0.05). In addition, an increase of 1 SD in NRS score were predicted to reduce the physical and mental component scores of SF-12 by 0.185 and 0.215, respectively. CONUT score were also found to have a negative effect on the physical component of SF-12 (p<0.05)**.**
Conclusions: It was concluded that the risk of malnutrition is high in individuals with cardiovascular diseases**.**

Key words: Cardiovascular disease; Comorbidity; CONUT score; Nutrition; quality of life.

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Background

Cardiovascular diseases include diseases of the heart and blood vessels such as coronary heart disease, peripheral vascular disease, congestive heart failure, stroke, congenital heart disease, rheumatic heart disease, hypertensive disease and arrhythmias (1). Cardiovascular diseases (CVD) are the most important cause of morbidity and mortality worldwide and constitute a significant portion of the global disease burden (2, 3).

Malnutrition is frequently encountered in individuals with cardiovascular disease as a result of inadequate energy intake related with anorexia and increased energy expenditure related with the inflammatory process (4, 5). In addition, individuals with heart disease are reported to be affected by cardiac cachexia, defined as 'involuntary weight and muscle loss'. Cachexia is accompanied by malnutrition, systemic nutritional deficiencies, elevated inflammatory cytokines, immune system hyperactivity and neuro-hormonal changes (6). Malnutrition and malnutrition-related cardiac cachexia in these patients are associated with prolonged hospital stay, mortality and morbidity (4, 6). Considering the pathophysiology of malnutrition and cachexia, it has been reported that increasing food intake in these patients may reduce catabolic effects and increase lean body mass (4). In this context, it is emphasized that early identification of patients with malnutrition risk and/or malnutrition is very important to start timely and adequate nutritional support (7).

Nutritional risk screening, which is a simple and rapid option to identify patients at risk of malnutrition, is recommended to be performed systematically in patients admitted to hospital (7). Although there are many screening tools to determine the nutritional status of patients receiving treatment in the clinic, it is also reported that there is no 'gold standard' screening tool (8). The European Society for Clinical Nutrition and Metabolism (ESPEN) recommends the use of the NRS-2002 screening tool in the evaluation of the nutritional status of clinic inpatients (9). Another screening tool, the Controlling Nutritional Status (CONUT) score, is a relatively new index that screens for nutritional risk through biochemical parameters. Although the CONUT score is reported to be easier and less costly than the NRS-2002, studies to evaluate its effectiveness in individuals with cardiovascular disease are ongoing (8, 10, 11).

It is emphasized that it is very important for healthcare professionals to plan the treatment of cardiovascular diseases by considering comorbidities. Because it has been reported that patients with comorbidities have decreased quality of life and increased mortality rates compared to patients without comorbidities (12). A study evaluating the relationship between mortality and nutrition associated with increased morbidities was published in 2006; however, in this study, the relationship between the risk of malnutrition and comorbidity was not analyzed and comorbidity was only evaluated according to the consumption status of food groups (13). In subsequent studies, the risk of malnutrition was assessed with various screening tools and nutritional status was associated with various clinical outcomes and some comorbidities (14-16). In the literature, no study was found in which nutritional status was evaluated with two different screening tools and associated with comorbidity index.

Individuals with cardiovascular disease may experience various symptoms such as fatigue, edema and sleep difficulties, and this leads to

a decrease in their quality of life. In this context, it is recommended that quality of life, which is associated with prolonged hospitalization, morbidity and mortality, should be assessed in every patient with a history of CVD (17). In various studies conducted in different patient groups, it has been reported that quality of life is associated with nutritional status (18, 19). In the literature, no study evaluating the relationship between nutritional status and quality of life in cardiovascular diseases was found.

In the light of all this information, this study was planned and conducted to evaluate the relationship between nutritional status comorbidities in individuals with cardiovascular disease. In addition, it is also aimed to evaluate the effect of nutritional status and comorbidity development on quality of life.

Material y methods

Study Plan

This cross-sectional and descriptive study was conducted in the cardiology clinic of University Hospitals between August 2021 and June 2022. The study population was defined as conscious patients older than 18 years of age who were receiving treatment in the cardiology clinic due to cardiovascular disease; patients with loss of consciousness and/or communication problems and patients in the terminal period were not included in the study. The sample size was determined as 125 individuals by using G*Power 3.1 computer program with Chi-Square test with type 1 error α=0.05, 1-β=0.90 and effect size 0.5. The study was completed with 127 participants.

Ethical approval was obtained for this study from the University Clinical Research Ethics Committee (decision number 2021/490). In addition, all individuals participating in the study were informed about the study and their written and verbal consents were obtained.

Data Collection

Demographic information of the individuals was obtained with the help of a questionnaire form; body weight, height, waist, hip, mid-upper arm and neck circumference measurements were taken by the researchers in accordance with the technique. Body mass index (BMI) [weight (kg)/height (m)^2] was calculated from the obtained weight and height measurements. Body mass index was assessed according to the WHO adult classification. A neck circumference greater than 34 cm was considered a risk for obesity (20).

NRS-2002 and CONUT score were used to screen the nutritional status of the patients. NRS-2002 was a two-part screening tool that scores the deterioration in the nutritional status of patients and the severity of diseases. In the first part, the severity of the disease, weight loss in three months and decreases in food intake in three months were questioned. The second part of the form was continued in patients who answered 'yes' to any of the questions in the first part. In the second part, patients were evaluated in terms of nutritional deficiency and disease severity, and a total score was determined by adding 1 point to the score obtained when the patient is 70 years of age or older. Patients with a total score of 3 and above were considered at risk of malnutrition (9).

CONUT score was calculated from serum albumin concentration, total cholesterol level and total lymphocyte level. In this assessment, individuals can score between 0 and 12; zero (0) score indicates a normal nutritional status, whereas an increase in the

score indicates a deterioration in the nutritional status of the individual. The calculation and evaluation of the CONUT score is given in table 1 (21).

Parameters	CONUT			
	Normal	Mild	Medium	Severe
Serum Albumin (g/dl)	3.5–4.5	3.0–3.49	2.5–2.9	<2.5
Albumin score	1	2	4	6
Total lymphocytes (number/mm³)	≥1600	1200-1599	800–1199	<800
Lymphocyte score	0	1	2	3
Total cholesterol (mg/dl)	>180	140-180	100-139	<100
Total cholesterol score	0	1	2	3
Total CONUT score	0-1	2-4	5-8	9-12
Evaluation	Normal	Mild	Medium	Severe

Table 1. Definition of the CONUT score.

Charlson Comorbidity Index (CCI) was used to evaluate the comorbidity status of the patients. This index was developed by Charlson et al. in 1987 as a mortality predictor scale. The index includes 19 medical conditions scored 1-6, with a total score ranging from 0-37. The total score obtained from the scale in which the age range is also taken into consideration gives the comorbidity score of the individual (22).

The quality of life of the patients was evaluated using the SF-12 Quality of Life Scale. This scale consists of 12 questions and is evaluated as physical component score (PCS) and mental component score (MCS). Scores between 0-100 can be obtained from the scale and high scores indicate good quality of life. The Turkish validity and reliability of the scale was performed by Koçyiğit et al (23).

Statistical Analysis of Data

Statistical analysis of the data of the study was performed using SPSS 22.0. In addition to applying the Shapiro-Wilk test, the kurtosis and skewness values were examined to evaluate the normality of the data. To determine comparisons between two groups, independent sample t test was applied. Between three or more groups, data were compared using one-way ANOVA. The relationships between the numerical variables were evaluated using Pearson correlation analysis. Furthermore, linear regression analysis was performed to evaluate the factors affecting the comorbidity index and quality of life. In all analyses, $p<0.05$ was considered statistically significant.

Results

The study was completed with 127 participants (72 male, 55 female) and the average age of the participants was 63.92±12.23 years. The mean CCI value of the participants was 3.96±1.81, CONUT score was 2.31±2.27, SF-12 physical component score was 34.70±8.97 and mental component score was 39.33±9.56.

Table 2 shows the mean CCI and CONUT scores and SF-12 evaluations according to the demographic characteristics of the participants. The mean CCI value was higher in singles than in married people (4.64±2.24, 3.77±1.63, respectively) (p=0.026). The CCI value of the participants who are retired (4.11±1.90) and housewives (4.26±1.70) is higher than the participants who work in other professions (2.95±1.58) (p=0.011). In the SF-12 assessment, the physical

component score was higher in men than in women (37.11±9.28, 31.54±7.53 respectively, p<0.001) and in married than in single (36.04±8.66, 29.96±8.57 respectively, p=0.001). SF-12 mental component score was higher in males than females (41.53±9.56, 36.46±8.85, respectively, p=0.003) and in married than in single (40.67±8.98, 34.61±10.22, respectively, p=0.003). It was determined that the mean SF-12 mental component scores of participants with high school and higher education (43.38±9.46) were higher than those of illiterates (35.89±7.28) (p=0.010) and literates (35.54±9.82) (p=0.028).

Table 2. CCI, CONUT and SF-12 scores according to the demographic characteristics of the participants.

	n (%)	CCI *(x ± ss)*	CONUT Score *(x ± ss)*	SF – 12	
				PCS *(x ± ss)*	MCS *(x ± ss)*
Age (year) (x ± ss)	63.92 ± 12.23				
Gender					
Male	72 (56.7)	3.80 ± 1.87	2.68 ± 2.52	37.11 ± 9.28	41.53 ± 9.56
Female	55 (43.3)	4.18 ± 1.73	1.83 ± 1.80	31.54 ± 7.53	36.46 ± 8.85
Total	127 (100.0)	3.96 ± 1.81	2.31 ± 2.27	34.70 ± 8.97	39.33 ± 9.56
		p=0.087[b]	*p*=0.056[b]	**p<0.001[b]**	**p=0.003[a]**
Marital Status					
Married	99 (78.0)	3.77 ± 1.63	2.11 ± 2.16	36.04 ± 8.66	40.67 ± 8.98
Single	28 (22.0)	4.64 ± 2.24	3.03 ± 2.54	29.96 ± 8.57	34.61 ± 10.22
		p=0.035[b]	**p=0.029[b]**	**p<0.001[b]**	**p=0.003[a]**
Educational Status					
Illiterate	28 (22.0)	4.42 ± 1.83	2.21 ± 1.96	31.62 ± 7.19	35.89 ± 7.28[μ]
Literate	12 (9.4)	4.33 ± 1.43	2.00 ± 1.47	30.16 ± 5.31	35.54 ± 9.82[Ⓟ]
Primary school	57 (45.0)	3.96 ± 1.80	2.28 ± 2.45	36.19 ± 9.58	40.06 ± 9.87
Middle school	13 (10.2)	3.30 ± 2.13	2.76 ± 2.48	35.17 ± 8.50	41.75 ± 10.19
High school and above	17 (13.4)	3.47 ± 1.73	2.47 ± 2.57	37.57 ± 10.14	43.38 ± 9.46[μⓅ]
		p=0.060[c]	*p*=0.829[c]	**p=0.049[c]**	**p=0.042[d]** **p=0.010[μ];** **p=0.028[Ⓟ]**
Job					
Retired	51 (40.2)	4.11 ± 1.90[μ]	2.80 ± 2.65	36.01 ± 9.47[μ]	40.34 ± 9.30
Housewife	53 (41.7)	4.26 ± 1.70[Ⓟ]	1.86 ± 1.82	31.32 ± 7.35[μβ]	36.33 ± 8.92[β]
Other	23 (18.1)	2.95 ± 1.58[μⓅ]	2.26 ± 2.15	39.57 ± 8.55[β]	44.01 ± 9.60[β]
		p=0.003[c] **p=0.027[μ];** **p=0.002[Ⓟ]**	p=0.217	**p<0.001[c]** **p=0.028[μ];** **p<0.001[β]**	**p=0.006[d];** **p=0.007[β]**
Smoking					
Non-smoker	71 (55.9)	4.04 ± 1.90[Ⓟ]	2.12 ± 2.24	32.54 ± 7.91[μ]	37.23 ± 8.63[μ]
Quitter	39 (30.7)	4.28 ± 1.71[μ]	2.76 ± 2.53	36.29 ± 9.65	40.69 ± 10.14
Smoker	17 (13.4)	2.94 ± 1.29[μⓅ]	2.05 ± 1.63	40.02 ± 9.08[μ]	45.00 ± 9.57[μ]
		p=0.019[c] **p=0.020[μ];** **p=0.034[Ⓟ]**	*p*=0.309[c]	**p=0.003[c];** **p=0.005[μ]**	**p=0.005[d];** **p=0.006[μ]**
Drinking alcohol					
Non-alcoholic	99 (78.0)	4.06 ± 1.94	2.18 ± 2.22	33.66 ± 8.71	38.58 ± 9.58
Ex-alcoholic	23 (18.1)	3.82 ± 1.15	3.13 ± 2.51	37.80 ± 9.37	40.94 ± 9.42
Alcoholic	5 (3.9)	2.80 ± 1.30	1.20 ± 0.83	40.88 ± 8.18	46.85 ± 6.77
		p=0.246[c]	*p*=0.101[c]	**p=0.032[c]**	*p*=0.113[d]

[a]Independent sample t-test, [b]Mann Whitney U test, [c]Kruskal-Wallis test, [d]ANOVA, [μ,Ⓟ, β]Post-hoc. CKİ Charlson Comorbidity Index, CONUT Controlling Nutritional Status, MCS Mental Component Summary, PCS Physical Component Summary, SF-12 Short Form Health Quality Questionnaire

CCI, CONUT and SF-12 evaluations of the participants according to their nutritional status evaluations are shown in table 3. It was determined that the SF-12 mental (40.56±9.58) component scores of the participants who underwent only preliminary assessment in the NRS-2002 screening were higher, and the SF-12 physical (35.41±9.06) and mental (39.50±9.51) component scores of the participants who underwent the main assessment were higher in those whose scores were below 3 ($p<0.05$). In addition, the mean CONUT score (3.38±2.89) of the participants with a basic assessment score of 3 and above was higher than the other participants (1.47±1.46) ($p<0.05$). It was determined that SF-12 physical (33.50±8.48) and mental (38.24±9.48) component scores were lower in participants with a CCI score of 3 and above than the other participants ($p<0.05$).

Table 3. CCI, CONUT and SF-12 scores according to the nutritional status of the participants.

	n (%)	CCI *(x ± ss)*	CONUT *(x ± ss)*	SF – 12	
				PCS *(x ± ss)*	MCS *(x ± ss)*
BMI (kg/m²)					
< 25.0	29 (22.8)	4.31 ± 2.08	2.93 ± 2.89	34.29 ± 10.30	38.52 ± 11.64
25.0–29.99	46 (36.2)	3.76 ± 1.44	2.19 ± 2.19	36.36 ± 9.18	40.39 ± 9.08
≥30.0	52 (40.9)	3.96 ± 1.94	2.07 ± 1.90	33.45 ± 7.88	38.85 ± 8.78
		p=0.415[c]	*p*=0.609[c]	*p*=0.251[c]	*p*=0.641[d]
NRS Evaluation					
Only initial screening	90 (70.9)	3.92 ± 1.76	2.27 ± 2.21	35.66 ± 9.13	40.56 ± 9.58
Final screening	37 (29.1)	4.08 ± 1.94	2.40 ± 2.44	32.34 ± 8.21	36.34 ± 8.94
		p=0.564[b]	*p*=0.858[b]	**p=0.034[b]**	**p=0.009[b]**
NRS Final Screening Score					
<3	19 (51.3)	3.57 ± 1.53	1.47 ± 1.46	35.41 ± 9.06	39.50 ± 9.51
≥3	18 (48.7)	4.61 ± 2.22	3.38 ± 2.89	29.10 ± 5.87	33.00 ± 7.12
		p=0.142[b]	**p=0.022[b]**	**p=0.012[b]**	**p=0.025[a]**
CONUT Score Evaluation					
Normal	58 (45.7)	3.91 ± 1.63	0.58 ± 0.49[‖ β]	36.13 ± 8.82[μ]	39.86 ± 9.28
Mild nutritional deficiency	51 (40.2)	3.74 ± 1.92	2.72 ± 0.89[μ‖]	34.97 ± 9.58	40.11 ± 9.78
Moderate and severe malnutrition	18 (14.1)	4.77 ± 1.92	6.72 ± 1.96[μ β]	29.30 ± 5.29[μ]	35.44 ± 9.41
		p=0.062[c]	**p<0.001[c]** **p=0.001[μ]; p<0.001[‖ β]**	**p=0.013[c]** **p=0.009[μ]**	*p*=0.264[c]
CCI					
<3	25 (19.7)	1.60± 0.50	1.84 ± 1.31	39.58 ± 9.46	43.77 ± 8.74
≥3	102 (80.3)	4.54 ± 1.52	2.43 ± 2.44	33.50 ± 8.48	38.24 ± 9.48
		p<0.001[b]	*p*=0.690[b]	**p=0.003[b]**	**p=0.014[b]**
Neck circumference					
Normal	29 (22.8)	3.86 ± 1.72	2.86 ± 3.62	34.61 ± 10.05	40.02 ± 10.32
Risky	98 (77.2)	4.00 ± 1.85	2.15 ± 2.14	34.72 ± 8.68	39.13 ± 9.37
		p=0.949[b]	*p*=0.190[b]	*p*=0.686[b]	*p*=0.662[a]

aIndependent sample t-test, bMann Whitney U test, cKruskal-Wallis test, dANOVA, μ,‖,βPost-hoc. BMI Body Mass Index, CCI Charlson Comorbidity Index, CONUT Controlling Nutritional Status, MCS Mental Component Summary, NRS Nutritional Risk Screening, PCS Physical Component Summary, SF-12 Short Form Health Quality Questionnaire

The correlation between nutritional status, CCI, SF-12 scores and anthropometric measurements of the participants is shown in table 4. Age was positively correlated with NRS-2002 (r=0.453) and CCI score (r=0.716), and negatively correlated with SF-12 physical

(r=-0.322) and mental (r=-0.336) component scores (p<0.05). NRS-2002 score was positively correlated with CCI (r=0.400) and CONUT score (r=0.561) and negatively correlated with SF-12 physical (r=-0.502) and mental (r=-0.468) component scores. CCI score was negatively correlated with both physical (r=-0.309) and mental (r=-0.296) component scores of SF-12 (p<0.05).

Table 4. The Relationship Between CCI, SF-12, NRS-2002 and Anthropometric Measurements.

r p-value	Age	NRS	CCI	CONUT	PCS	MCS	BW	BMI	NC
NRS	0.496 **0.002***								
CCI	0.716[a] **0.000***	0.379 **0.021***							
CONUT	0.108 0.226	0.491 **0.002***	0.090 0.312						
PCS	-0.311 **0.000***	-0.484 **0.002***	-0.297 **0.001***	-0.256 **0.004***					
MCS	-0.276 **0.002***	-0.441 **0.006***	-0.304 **0.001***	-0.157 0.078	0.552 **0.000***				
BW	-0.096[a] 0.284	-0.132 0.436	-0.116[a] 0.193	0.024 0.787	0.072 0.420	0.113 0.205			
BMI	0.065[a] 0.467	0.033 0.844	-0.021[a] 0.816	-0.022 0.804	-0.098 0.272	-0.053 0.552	0.860[a] **0.000***		
NC	0.029[a] 0.748	0.008 0.961	-0.013[a] 0.883	-0.064 0.475	0.148 0.096	0.088 0.323	0.523[a] **0.000***	0.361[a] **0.000***	
MAC	-0.049 0.583	-0.139 0.411	-0.053 0.556	0.013 0.882	0.039 0.666	0.159 0.074	0.657 **0.000***	0.656 **0.000***	0.519 **0.000***

Spearman correlation analysis, aPearson correlation analysis. BMI Body Mass Index, BW body weight, CCI Charlson Comorbidity Index, CONUT Controlling Nutritional Status, MCS Mental Component Summary, NC neck circumference, NRS Nutritional Risk Screening, PCS Physical Component Summary, MA Cupper mid-arm circumference, SF-12 Short Form Health Quality Questionnaire.

Tables 5 and 6 show the results of the linear regression analysis of factors that may affect the CCI and quality of life. While gender, marital status, smoking, NRS, and CONUT scores were not shown to be effective on CCI, a 1 SD increase in age is estimated to increase the CCI by 0.692 SD. An increase of 1 SD in the NRS score was predicted to reduce the physical and mental component scores of the SF-12 by 0.185 and 0.215, respectively. Gender and CONUT score were also found to have a negative effect on the physical component of SF-12 (p<0.05).

Table 5. Factors affecting Charlson Comorbidity Index.

	Beta	t	p-value	95% CI	
				Lower	Upper
Age	0.692	10.652	**0.000***	0.084	0.122
Gender	-0.057	-0.648	0.518	-0.843	0.427
Marital Status	0.102	1.498	0.137	-0.143	1.032
Smoking	-0.115	-1.389	0.167	-0.705	0.124
NRS Score	-0.010	-0.155	0.877	-0.196	0.167
CONUT Score	0.043	0.643	0.521	-0.071	0.140
	Adjusted R^2 =0.508; *p<0.001*				

Linear regression analysis.

Table 6. Factors affecting quality of life.

	Beta	t	p-value	95% CI	
				Lower	Upper
SF-12 (PCS)					
Age	-0.153	-1.388	0.168	-0.272	0.048
Gender	-0.235	-2.114	**0.037***	-8.230	-0.269
Marital Status	-0.124	-1.467	0.145	-6.272	0.935
Educational Status	-0.024	-0.254	0.800	-1.475	1.139
Smoking	0.148	1.467	0.145	-0.648	4.355
NRS Score	-0.185	-2.363	**0.020***	-2.365	-0.209
CCI	-0.066	-0.598	0.551	-1.399	0.750
CONUT Score	-0.243	-3.012	**0.003***	-1.590	-0.329
	Adjusted R^2 =0.288; *p<0.001*				
SF-12 (MCS)					
Age	-0.195	-1.719	0.088	-0.329	0.023
Gender	-0.114	-0.990	0.324	-6.558	2.185
Marital Status	-0.121	-1.395	0.166	-6.745	1.169
Educational Status	0.058	0.605	0.547	-0.997	1.874
Smoking	0.175	1.684	0.095	-0.411	5.083
NRS Score	-0.215	-2.655	**0.009***	-2.771	-0.403
CCI	-0.030	-0.269	0.789	-1.340	1.020
CONUT Score	-0.141	-1.696	0.093	-1.286	0.099
	Adjusted R^2 =0.244; *p<0.001*				

Linear regression analysis.

Discussion

Cardiovascular diseases are the leading cause of global mortality and cause a decrease in quality of life in individuals with these diseases (24). Cardiovascular diseases are also among the leading diseases that are significantly affected by nutrition, and deterioration in nutritional status is associated with the clinical status and physical performance of patients. In this context, it is accentuated that the assessment of nutritional status has an important role in the treatment process. There are different screening tools recommended to assess the nutritional status of patients. It is emphasized that the CONUT score is an important determinant of clinical outcomes in cardiovascular diseases because it evaluates albumin, total cholesterol and lymphocyte levels and is easy and fast to apply (14, 25). In a study evaluating the nutritional status of individuals over 80 years of age with cardiovascular disease, it was reported that 62.9% of patients had malnutrition according to CONUT score evaluation. It was also noted that patients with severe malnutrition had the worst clinical outcomes (14). In another study, the nutritional status of 547 coronary artery disease patients was evaluated with the CONUT score; 41% of patients had mild malnutrition and 10% had moderate to severe malnutrition. It was emphasized that patients with malnutrition have a higher risk of cardiovascular death than those without malnutrition; therefore, nutritional interventions should be made in a timely and effective manner (26). In patients undergoing coronary artery bypass, CONUT score has been reported to be associated with renal complications, hemorrhage and mortality rates (16).

Unintended weight loss associated with the disease or weight loss during treatment is highlighted as the most important parameter of health-related malnutrition. The degree of this unintended weight loss and the duration of weight loss are also components that need to be assessed. In this context, the NRS-2002

screening tool developed and recommended by ESPEN is also reported to be associated with hospitalization duration and complication rates in cardiovascular diseases (9, 15).

In this study, the nutritional status of the patients was evaluated with the NRS-2002 screening tool and CONUT score. According to NRS-2002, 29.1% of the patients passed from pre-assessment to main assessment and 48.7% of the patients who underwent main assessment were found to have malnutrition risk. CONUT score evaluation revealed that 40.2% of the patients had mild malnutrition and 14.2% had moderate and severe malnutrition. It was found that the NRS-2002 score of the patients and the CONUT score were positively correlated; as the NRS-2002 score increased, the comorbidity index score also increased. In the regression modelling, it was determined that the increase in age increased the comorbidity. These results reveal that the age has an important effect on the development of comorbidity in patients, as well as nutritional status.

Anthropometric measurements, defined as non-invasive quantitative measurements of the body, have an important place in evaluating the prognosis of diseases and guiding medical intervention. It is recommended that these measurements should be used in determining the disease risks of individuals as well as in the evaluation of nutritional status. Body weight, height, body mass index (BMI) and circumference measurements (waist, hip, neck, etc.) are the basic elements of anthropometric measurements and it is of great importance that these measurements are performed by trained health personnel. In this way, it is emphasized that it will provide more reliable results in assessing nutritional status compared to methods that are complicated and costly to use (27, 28).

In this study, body weight, height, waist, hip, upper middle arm and neck circumference measurements were taken. Body weight was positively correlated with neck circumference and upper middle arm circumference. While no significant correlation was found between BMI and comorbidity scores of the patients, it was observed that patients with malnutrition risk had a higher risk of comorbidity. These results show that anthropometric measurements alone are not sufficient in the assessment of nutritional status and the risk of comorbidity; it is important to perform the assessment together with screening tools that also evaluate disease status and various biochemical data.

Quality of life is recognized as an important indicator for clinical outcomes in individuals with cardiovascular disease (29). In studies conducted with various patient groups, it has been reported that quality of life decreases as comorbidities increase in patients (30, 31). In addition, it is underlined that nutritional status is also an important marker for quality of life; it is reported that significant improvements in quality of life occur with improvements in nutritional status.[18,19] In this study, it was observed that as the comorbidity score of the patients increased, both physical and mental sub-dimension scores of quality of life decreased. Similarly, it was determined that the quality of life of the patients decreased as the risk of malnutrition increased. In the regression analysis, it was estimated that an increase of 1 SD in the NRS score would decrease the physical and mental component scores of SF-12 by 0.185 and 0.215, respectively. The CONUT score was found to have a negative effect on the physical component of SF-12. Although there are studies evaluating the relationship between nutritional status and comorbidities and quality of life in different patient groups in the literature, no studies investigating

these relationships in cardiovascular diseases have been found. In this context, this study is important in terms of examining these parameters, which have been investigated in other patient groups, in cardiovascular diseases.

To the best of our knowledge, our study is the first to examine the relationship between nutritional status, comorbidities and quality of life in cardiovascular diseases. However, since our study was planned as a cross-sectional study, it only reflects the data of patients in a single centre in Turkey.

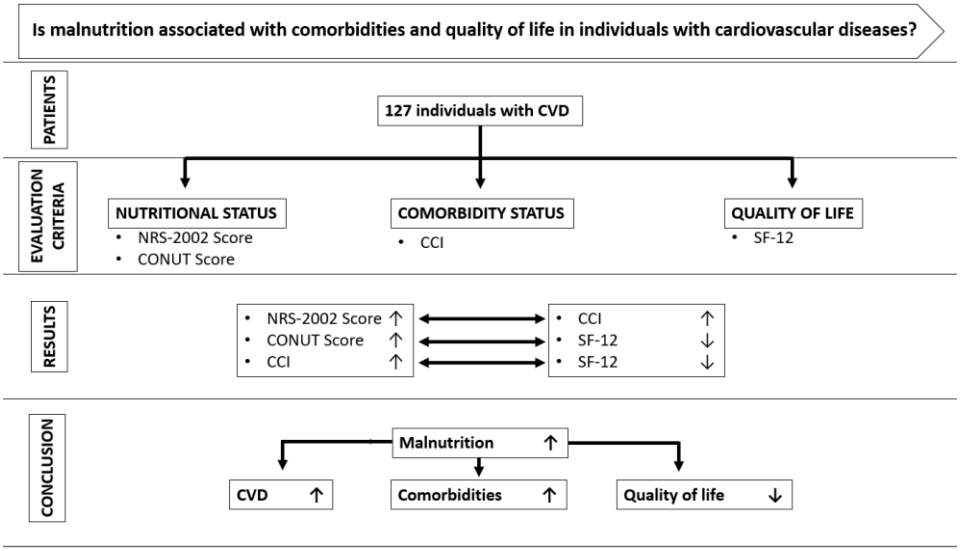

Figure 1. Relationship between cardiovascular diseases, malnutrition, and quality of life.

Conclusions

In the study, it was concluded that the risk of malnutrition is high in individuals with cardiovascular diseases and this poses a risk in terms of both comorbidities that may develop and quality of life (Figure 1). Assessment of the nutritional status of patients should be considered an important step to prevent the development of comorbidities and thus support the medical treatment of cardiovascular diseases with a high mortality burden globally. In the study, it was determined that the CONUT score of the patients showed a positive correlation with the NRS-2002 score; therefore, it can be said that the CONUT score, which allows the evaluation of biochemical parameters in addition to NRS-2002, should be taken into consideration in the evaluation of nutritional status.

In addition to reducing mortality rates in cardiovascular diseases, it is of great importance to improve quality of life, which has been found to be associated with nutritional status and comorbidities. In the light of these results, it should be aimed to reduce the development of comorbidities and improve the quality of life with improvements in the nutritional status of patients.

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