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ASSESSMENT OF NUTRITIONAL STATUS IN CORONARY ARTERY DISEASE PATIENTS IN KHYBER PAKHTUNKHWA: A MULTI-CENTER CROSS SECTIONAL STUDY

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ABSTRACT

Introduction: Coronary Artery Disease (CAD) is a major cause of illness and death, caused by the narrowing of coronary arteries. Proper nutrition is essential for managing CAD, as malnutrition can worsen the condition and impair recovery. Assessing nutritional status is key to improving health outcomes in CAD patients.

Objective: This study aimed to assess the nutritional status of coronary artery disease (CAD) patients in Khyber Pakhtunkhwa using the Mini Nutritional Assessment (MNA) questionnaire, concentrating on determining the variables linked to the risk of malnutrition.

Material and Methods: A multi-center, cross-sectional study was conducted in KPK in Mardan Medical Complex, Bacha Khan Medical Complex Swabi and LRH Peshawar from July 2024 to December 2024 using a convenient sampling technique to include 362 CAD patients with ages ranging from 20 to 91 years. MNA questionnaire was used to collect data. Using SPSS version 22, to analysis the data. Mean and standard deviation were determined for age using descriptive statistics, and frequency and percentages were determined for categorical variable.

Results: A total 362 coronary artery disease patients having, minimum age was 20 years and maximum was 91 years the mean age of the participants was 58.1 ±14.1 years. Of the total sample, 187 patients were male, and 175 patients. The mean Body Mass Index (BMI) was 25.9 ±8.2. Employment status showed 64% unemployed, 32.8% employed, 4.1% retired, and 1.7% students. Regarding income, 83.4% had low, 13% middle, and 3.6% high income. CAD duration was under a year for 59.4%, 1-5 years for 23.8%, and over 5 years for 16.9%. Of the patients, 60.5% had lost more than 3 kg, and 42.8% experienced stress/acute disease. The results indicated that 11.3% of patients were malnourished, 54.4% were at risk of malnutrition, and 34.3% had acceptable nutritional status

Conclusion: This study emphasizes how common malnutrition risk is among CAD patients in Khyber Pakhtunkhwa. Given that more than half of the participants were either malnourished or at risk, the results emphasize the critical need for targeted nutritional interventions and support to enhance health outcomes and avoid the consequences linked to undernutrition in this population.

Keywords: Coronary Artery Disease, Nutritional Status, Mini Nutritional Assessment

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INTRODUCTION

Coronary artery disease (CAD) is a major term used for conditions affecting the heart and blood vessels, and it remains one of the leading cardiovascular diseases globally. It is recognized as a primary cause of mortality and disability in both developed and developing nations. CAD commonly develops due to the accumulation of fatty deposits (atherosclerosis) inside the coronary arteries, leading to reduced blood flow to the heart muscle and increasing the risk of myocardial infarction, arrhythmias, and heart failure [1-3]. Globally, cardiovascular mortality accounts for approximately 50–55% of all deaths, while coronary heart disease alone contributes to nearly half of these deaths [4]. Current estimates indicate that the prevalence of coronary (ischemic) heart disease was around 200 million individuals worldwide in 2019. Pakistan is also heavily burdened by CAD, and the prevalence of risk factors in the Pakistani population remains high, including high-fat dietary consumption, obesity, sedentary lifestyle, hypertension, and diabetes. Diet plays an important role in the development and progression of CAD, as poor dietary quality is closely linked to high cholesterol, raised blood pressure, oxidative stress, type 2 diabetes, and obesity [5].

According to global analysis, there were 315 million (95% UI: 273–362) prevalent cases of CAD in 2022. The age-standardized prevalence rate was found to be 3605 per 100,000 population, reflecting an 18% decrease since 1990 [6]. Central Europe, Eastern Europe, and Central Asia reported the highest age-standardized prevalence, while South Asia demonstrated the lowest (2393 per 100,000 population). Data from the REACH registry showed that 18–35% of CAD patients and 46–68% of PAD patients had disease in one or more vascular beds [7]. Annually, CAD accounts for nearly 7 million deaths and around 129 million disability-adjusted life years (DALYs) worldwide, particularly affecting low- and middle-income countries [4]. This shows that CAD not only poses medical complications but also contributes significantly to socio-economic burden.

Nutrition plays a strong role in CAD prognosis. Recent studies have emphasized that malnutrition greatly increases the risk of mortality and complications in CAD patients. For example, a study by Kazuhiro Anzaki et al. (2023) demonstrated that malnutrition, assessed by the geriatric nutritional risk index (GNRI), was significantly associated with higher all-cause mortality and major cardiovascular and cerebrovascular events after percutaneous coronary intervention (PCI). Malnourished patients also showed more severe coronary calcification (22% vs 5%, $P < 0.001$) [8].

Dietary patterns also influence CAD outcomes. Studies have shown that Mediterranean-style and vegetarian diets can reduce the risk of major cardiovascular events. The Lyon Diet Heart Study demonstrated a 72% reduction in myocardial infarction and cardiac death with a Mediterranean diet in secondary prevention [9]. The PREVENTION With Mediterranean Diet (PREDIMED) trial also found a 30% reduction in major cardiovascular events in individuals who followed Mediterranean diets supplemented with extra virgin olive oil or nuts [3]. A case-control study conducted by Armani et al. (2010) showed that consumption of fish, tea, and vegetable oils had a protective effect against CAD while intake of hydrogenated fats and full-fat dairy significantly increased risk [6].

Therefore, growing evidence suggests that nutritional status is not only a contributing factor in the development of CAD but also strongly influences disease severity, prognosis, and mortality outcomes. Malnutrition—particularly protein-energy malnutrition—has emerged as a key independent factor impacting survival in CAD patients. Evaluation tools

such as Mini Nutritional Assessment (MNA), Controlling Nutritional Status (CONUT), and Geriatric Nutritional Risk Index (GNRI) are now increasingly used to determine which CAD patients are at risk. Multiple studies, including those by Wada et al. (2017) and Kunimura et al. (2017), have demonstrated that high CONUT and low GNRI scores are strong predictors of adverse cardiac events, hospitalization, and mortality (8-10). Evidence strongly supports the importance of early nutritional screening and targeted dietary interventions in all patients diagnosed with CAD.

Given the high prevalence of CAD in Pakistan and the strong association between nutrition and CAD outcomes, there is a need to assess the nutritional status of CAD patients in this region. Evaluating malnutrition among CAD patients will help to identify high-risk groups and guide nutritional counselling and management to reduce disease complications and improve quality of life.

MATERIALS AND METHODS

Study Design

This was a multicenter, cross-sectional study. Participants were recruited according to pre-determined eligibility criteria.

Study Settings

The study was conducted in multiple tertiary care hospitals in Khyber Pakhtunkhwa (KPK), Pakistan. The study sites included Mardan Medical Complex (MMC) Mardan, Bacha Khan Medical Complex (BKMC) Swabi, and Lady Reading Hospital (LRH) Peshawar.

Sampling Technique

A non-probability convenience sampling technique was used for the selection of study participants.

Sample Size

The sample size was calculated using a prevalence of 37.9% (40). The level of significance was taken as 5%, with a 95% confidence interval, resulting in a minimum required sample size of 362 participants.

Study Duration

Data collection was conducted over a period of six months, from July 2024 to December 2024.

Sample Collection

Inclusion Criteria

- Patients diagnosed with Coronary Artery Disease (CAD)
- Aged >18 years
- Willing to participate in the study

Exclusion Criteria

- CAD patients with Diabetes Mellitus
- Pregnant women
- Patients with a known history of cancer
- History of chronic liver or kidney disease

Data Collection Procedure

A multicenter cross-sectional study was conducted in KPK to assess the nutritional status of patients with coronary artery disease. Data collection continued until the required sample size was completed. Ethical considerations regarding patient privacy and confidentiality were addressed in accordance with departmental guidelines, and informed verbal consent was obtained from all participants prior to enrollment.

Data were collected using the standardized Mini Nutritional Assessment (MNA) questionnaire as the primary measurement tool. Information collected included socio-demographic variables (age, gender, occupation, income level), clinical variables (hypertension, BMI, hyperlipidemia), and nutrition-

related variables (dietary intake, chewing/swallowing difficulties, appetite, feeding patterns). A validated research proforma was used to record all measurements.

Statistical Analysis

Data were analyzed using IBM SPSS version 22 and Microsoft Excel 365. Descriptive statistics such as mean and standard deviation were calculated for continuous variables including age, height and BMI, while frequencies and percentages were used to summarize categorical variables such as gender, occupation, household status, income level, appetite, chewing and swallowing difficulties, mobility status, hypertension, hyperlipidemia, obesity, food intake and feeding patterns. The Chi-square test was applied to determine associations between nutritional status (MNA categories) and categorical variables including age groups, gender, and dietary intake patterns. Independent samples t-test was used to compare mean differences in MNA scores between gender groups and between younger and older participants. A p-value <0.05 was considered statistically significant for all analyses.

RESULT

The mean age of the participants was 58.1 ± 14.1 years, with a nearly equal gender distribution, where 51.7% were male and 48.3% were female. The mean BMI of the study population was 25.9 ± 8.2 kg/m². Most of the participants were unemployed (62.4%), followed by employed individuals (31.8%), whereas only a small proportion were retired (4.1%) or students (1.7%). A majority of the patients belonged to the low-income category (83.4%), while only 13.0% and 3.6% fell into the middle- and high-income groups respectively. Regarding clinical history, more than half of the patients (59.4%) had been diagnosed with CAD for less than one year, 23.8% had CAD for 1–5 years, and 16.9% had CAD for over five years. Hypertension was reported in 57.2% of participants and 42.8% reported no history of hypertension. Similarly, 42.5% of the participants had hyperlipidemia while 57.5% did not have this condition. Among those diagnosed with hyperlipidemia, 37.3% were on lipid-lowering medication, whereas 62.7% were not taking any medication for hyperlipidemia.

Table 1: Demographic and Clinical Characteristics of Participants (N = 362)

Variable	Categories / Value	n (%) / Mean (±SD)
Age (years)	Mean ± SD	58.1 ± 14.1
Gender	Male	187 (51.7)
	Female	175 (48.3)
BMI (kg/m²)	Mean ± SD	25.9 ± 8.2
Occupation	Employed	115 (31.8)
	Unemployed	226 (62.4)
	Retired	15 (4.1)
	Student	6 (1.7)
Income Level	Low	302 (83.4)
	Middle	47 (13.0)
	High	13 (3.6)
History of CAD	< 1 year	215 (59.4)
	1–5 years	86 (23.8)
	> 5 years	61 (16.9)
Hypertension status	Yes	207 (57.2)
	No	155 (42.8)
Hyperlipidemia status	Yes	154 (42.5)
	No	208 (57.5)
Hyperlipidemia medication	Yes	135 (37.3)
	No	227 (62.7)

The majority of patients (60.5%) had lost more than 3 kg, while 11.3% were unsure of their weight loss, 10.2% had lost between 1 and 3 kg, and 18.0% had not lost any weight; 42.8% of patients reported experiencing stress or acute disease, while 57.2% did not; half of the patients (50.3%) had severe dementia, 23.8% had mild dementia, and 26.0% had no neurophysiological issues. A significant portion of patients experienced a severe decrease in food intake (34.3%), followed by a moderate decrease (33.7%), and 32.0% had none at all. While 16.9% of patients had a BMI between 21 and 23, 15.2%

had a BMI between 19 and 21, and 12.7% had a BMI below 19, the majority of patients (55.2%) had a BMI of 23 or above. Three meals a day were consumed by the majority of patients (57.7%), followed by two meals (27.6%), more than three meals (8.6%), and one meal (6.1%). As in Table 2.

Table 2: Screening of Study Participants

Screening		**Value, N=362**
		n (%)
Food intake of patient	Severe decrease	124 (34.3)
	Moderate decrease	122 (33.7)
	No decrease	116 (32.0)
Weight loss status	Weight loss greater than 3kg	219 (60.5)
	Does not know	41 (11.3)
	Weight loss betwwen1and3kg	37 (10.2)
	No weight loss	65 (18.0)
Mobility of patient	Bed or chair bound	72 (19.9)
	Gets out but doesn't go out	81 (22.4)
	Goes out	209 (57.7)
Stress or acute disease status	Yes	155 (42.8)
	No	207 (57.2)
Patient neurophysiological problem	Severe dementia	182 (50.3)
	Mild dementia	86 (23.8)
	None	94 (26.0)
BMI status of patient	<19	46 (12.7)
	19-21	55 (15.2)
	21-23	61 (16.9)
	23 or greater	200 (55.2)
Meal per day status of patient	1 meal	22 (6.1)
	2 Meal	100 (27.6)
	3 Meal	209 (57.7)
	>3	31 (8.6)

The following are some nutrition-related characteristics for a sample of 362 patients: Most patients were independent in their daily lives (66.3%), while 33.7% were not; most patients had prescription medications (70.2%), while 29.8% did not receive any; most patients ate three meals a day (59.4%), followed by two meals (30.9%) and one meal (9.7%); most patients did not consume dairy (74.3%), while 25.7% did; 27.9% of patients consumed legumes and eggs, while 72.1% did not; a smaller percentage (26.2%) consumed meat, fish, and poultry, while 73.8% did not. A majority of patients had no difficulty eating (58.6%), while 32.6% had some difficulty and 8.8% were unable to eat without assistance; the majority of patients did not perceive any nutritional issues (68.2%), while 13.3% considered themselves malnourished and 18.5% were uncertain; 36.2% felt their health was as good as before, while 33.7% felt it was not as good, 23.5% considered it better, and 6.6% were unsure; and only 22.4% consumed fruits and vegetables, compared to 77.6% did not. As in table 3

Table 3: Nutrition assessment of study participants

Nutrition Assessment		**Value,**
		n (%)
Independent life of patient	Yes	240 (66.3)
	No	122 (33.7)
Prescribe medication of patient	Yes	254 (70.2)
	No	108 (29.8)
Full meal per day status	1 Meal	35 (9.7)
	2 Meal	112 (30.9)
	3 Meal	215 (59.4)
Dairy intake status	Yes	93 (25.7)
	No	269 (74.3)
Legumes and egg taking status	Yes	101 (27.9)
	No	261 (72.1)
Meat, fish and poultry status	Yes	95 (26.2)
	No	267 (73.8)
Fruit and vegetable consumption status	Yes	81 (22.4)
	No	281 (77.6)
Fluid intake status of patient	<3 cups	75 (20.7)
	3-5 cups	81 (22.4)
	>5 cups	206 (56.9)
Mode of Feeding of patient	Unable to eat without assistance	32 (8.8)
	Some difficulty	118 (32.6)
	No difficulty	212 (58.6)
Self-view Nutritional Status of patient	Malnourished	48 (13.3)
	Uncertain	67 (18.5)
	No problem	247 (68.2)
Health Status Comparison of patient	Not as good	122 (33.7)
	Does not know	24 (6.6)
	As good	131 (36.2)
	Better	85 (23.5)

In this study, 362 patients' nutritional status was assessed using the Mini Nutritional Assessment (MNA) score. The MNA score falls into one of the following categories, with a range of 0 to 30: A risk of malnutrition is indicated by 17 to 23.5 points, while 24 to 30 points indicate normal nutritional and Under 17 points, which denotes malnutrition.There was a range of nutritional statuses within the sample, with the majority of the sample falling within the "at risk of malnutrition" category. The sample's mean MNA score was 21.7±4.0, indicating that, on average, the patients were at risk of malnutrition. The standard deviation of the scores shows a moderate variation in the scores, indicating that, although many patients were close to the average, there was a range of nutritional statuses within the sample. This statistical analysis emphasises the need for nutritional interventions and monitoring for a significant portion of the population in this study.as shown in figure 1

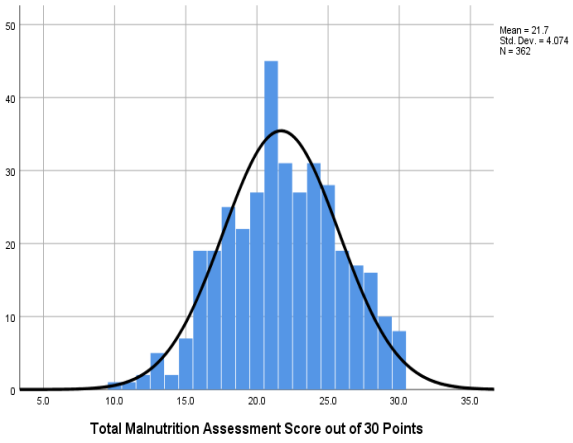

Figure 1: Total malnutrition indiactor score

Comparison between various variables such as age, gender, there was statistically significant association with age as ($p<0.05$). But gender was not statistically significant variable as ($p>0.05$)

Table 4: MNA score comparison in various variables

Variables		MNA Score Mean (±SD)	P-value
Age Categories	Young (≤ 45 Years) (N=66)	22.9 (3.4)	0.01
	Old ≥ 46 Years (N=296)	21.4 (4.1)	
Gender	Male (N=187)	22.0(4.1)	0.06
	Female (N=175)	21.2(3.9)	

Association of malnutrition status with different variables. So age was not statistically significant association with malnutrition status as ($p=0.08$). Food intake of patient, meal per day status of patient, full meal per day status of patient was statistically significant association with malnutrition status ($P=0.001$) and dairy intake status was not statistically significant association as ($p= 0.97$). Legumes and egg taking status was not statistically significant association as ($p= 0.28$). Meat, fish and poultry status was not statistically significant association as ($p= 0.40$). Fruit and vegetable consumption status of patient was also not statistically significant association as ($p=0.87$). Fluid intake status of patient was not statistically significant association as ($p=0.19$) and mode of feeding of patient was statistically significant association as ($p=0.001$).

Table 5: Association between malnutrition status with different variable

Variables		Malnutrition Status, n (%)			P-value
		Normal Nutritional Status	At risk of Malnutrition	Malnourished	
Gender	Male	74(20.4)	93(25.7)	20(5.5)	0.08
	Female	50(13.8)	104(28.7)	21(5.8)	
Food intake of patient	Severe decrease	12(3.3)	81(22.4)	31(8.6)	
	Moderate decrease	36(9.9)	78(21.5)	8(2.2)	0.001
	No decrease	76(21.0)	38(10.5)	2(0.6)	

Meal per day status of patient	1 Meal	1(0.3)	12(3.3)	9(2.5)	0.001
	2 Meal	14(3.9)	64(17.7)	22(6.1)	
	3 Meal	90(24.9)	109(30.1)	10(2.8)	
	>3	19(5.2)	12(3.3)	0(0.0)	
Full meal per day status of patients	1 Meal	6(1.7)	16(4.4)	13(3.6)	0.001
	2 Meal	25(6.9)	66(18.2)	22(6.1)	
	3 Meal	93(25.7)	115(31.8)	6(1.7)	
Dairy intake status	Yes	31(8.6)	50(13.8)	11(3.0)	0.97
	No	93(25.7)	147(40.6)	30(8.3)	
Legumes and egg taking status	Yes	38(10.5)	50(13.8)	15(4.1)	0.28
	No	86(23.8)	147(40.6)	26(7.2)	
Meat, fish and poultry status	Yes	38(10.5)	49(13.5)	9(2.5)	0.40
	No	86(23.8)	148(40.9)	32(8.8)	
Fruit and vegetable consumption status	Yes	26(7.2)	45(12.4)	10(2.8)	0.87
	No	98(27.1)	152(42.0)	31(8.6)	
Fluid intake status of patient	<3 cups	23(6.4)	41(11.3)	12(3.3)	0.19
	3-5 cups	27(7.5)	41(11.3)	13(3.6)	
	>5 cups	74(20.4)	115(31.8)	16(4.4)	
Mode of feeding of patient	Unable to eat without assistance	8(2.2)	17(4.7)	7(1.9)	0.001
	Some difficulty	26(7.2)	68(18.8)	26(7.2)	
	No difficulty	90(24.9)	112(30.9)	89(2.2)	

DISCUSSION

This multicenter cross-sectional study assessed the nutritional status of Coronary Artery Disease (CAD) patients using the Mini Nutritional Assessment (MNA) tool. The findings revealed that out of 362 CAD patients, 124 (34.3%) had normal nutritional status, 197 (54.4%) were at risk for malnutrition, and 41 (11.3%) were malnourished. These findings are consistent with other international studies. For example, Moradi Moghaddam et al. (2022) reported that 52.1% of patients had normal nutrition while 25.2% and 22.7% were at risk or malnourished respectively (11). Similarly, a study by Calvo et al. (2012) involving patients aged ≥65 years in a tertiary-care hospital showed that 77% were at risk of malnutrition based on MNA-SF screening (12). Another study by Faiza Kamal et al. (2016) from Mayo Hospital, Lahore, revealed that 40% of surgical patients were malnourished and 32% were at risk, while only 28% were normally nourished. Interestingly, in that study, malnourished patients had a higher 30-day mortality and complication rate, confirming the clinical impact of poor nutrition on outcomes (13). In the present study, male patients demonstrated a higher proportion of normal nutrition (20.4%) compared to females (13.8%), whereas females had a higher prevalence of being at risk for malnutrition (28.7%) compared to males (25.7%), though the difference did not reach statistical significance ($p = 0.08$). This trend is consistent with the findings by Mandecka et al. (2018), reporting that 29% of women and 18.2% of men were at risk of malnutrition (14). Likewise, Kshatriya et al. (2016) reported that 47.4% of women were undernourished compared to 32.1% of men (15). These findings collectively indicate that female patients are generally more vulnerable to malnutrition due to higher biological, hormonal, psychosocial, and socioeconomic risk factors and inequities in access to nutritious food.

With respect to age, this study found a statistically significant difference in MNA scores between younger (≤45 years) and older (≥46 years) CAD patients. Younger patients had a mean MNA score of 22.9 ± 3.4 while older patients demonstrated a lower mean score of 21.4 ± 4.1 ($p = 0.01$), suggesting deterioration of nutrition with increasing age. This is similar to Nozawa

et al. (2023) who found that 50% of elderly cardiac patients had malnutrition or were at risk (46). In contrast, Peterman et al. (2000) reported that although the mean MNA was 20.5 ± 5.1 and severe malnutrition prevalence was 21.7%, there was no association of nutritional status with gender or age (16-18). Furthermore, severe food intake reduction in this study was significantly associated with malnutrition ($p = 0.001$), indicating dietary intake as a major determinant of nutritional outcomes. The mean BMI of participants was 25.9 ± 8.2, indicating that most individuals were overweight by BMI scale. However, despite elevated BMI, a high proportion were still malnourished or at nutritional risk. This reveals an important concept—that BMI alone is not a reliable indicator of nutritional health in chronic diseases like CAD. Similar findings were reported by Maryam (2020) where 45% of subjects were overweight and yet all subjects were at risk according to the Nutritional Risk Index (19-21). In the present study, CAD history, hypertension, hyperlipidemia, BMI, and meal frequency were explored to assess correlations with nutritional status. Most participants (59.4%) had CAD for less than one year, and 57.2% had hypertension, whereas 42.5% had hyperlipidemia. More than half (55.2%) had BMI ≥23, while 12.7% had BMI <19, indicating mixed nutritional patterns within the sample. Meal frequency also varied—most (57.7%) consumed three meals per day, whereas 27.6% consumed two meals and 6.1% consumed only a single meal per day. This implies that lower food frequency and lower BMI were likely associated with poorer nutritional status in CAD. Findings from Rattan Kaur Chawla and Muhammad Arif (2013) reinforce these patterns, where poor dietary intake and sedentary lifestyle among cardiac patients resulted in significant macro-nutrient deficiencies and placed them at nutritional risk (23).

Based on these findings, it is recommended that routine nutritional screening should be implemented for CAD patients using structured tools such as MNA in all cardiac settings. Nutrition counseling should be prioritized particularly for high-risk groups such as elderly patients, female patients, low-income individuals, and those with reduced food intake or low meal frequency. Providing guidance on nutrient-dense, affordable food options, improving meal distribution across the day, ensuring adequate protein intake, and managing comorbidities such as hypertension and hyperlipidemia through lifestyle modifications are essential. Further research is needed to evaluate long-term outcomes of nutrition-focused interventions in CAD patients, as improving nutritional status may improve quality of life, reduce complication rates, and potentially improve survival in this population.

CONCLUSION

This study using the Mini Nutritional Assessment (MNA) identified that only 34.3% of CAD patients in Khyber Pakhtunkhwa had normal nutritional status, while 54.4% were at risk of malnutrition and 11.3% were already malnourished. These findings highlight a major public health concern as poor nutrition can negatively influence disease progression and recovery among cardiac patients. Meal frequency and feeding difficulties were important contributors to poor nutritional outcomes, indicating that many patients are not consuming adequate protein, vegetables, and dairy products. Therefore, routine nutritional screening, individualized dietary counselling, and targeted nutritional interventions are strongly recommended to improve the nutritional status and overall health outcomes in CAD patients.

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