Coronary artery stenosis and associations with indicators of anthropometric and diet in patients undergoing coronary angiography

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Abstract

Background Coronary artery diseases (CAD) are one of the major causes of mortality, which is related to the nutritional status and anthropometric indices of individuals. The aim of this study was to determine the relationship between anthropometric indices, the type of protein consumption in meat group and vegetable consumption with coronary artery stenosis.

Methods This descriptive and analytical cross-sectional study was conducted in Shariati Hospital in Tehran in 2016. Out of the patients undergoing coronary angiography, 208 cases were assigned to participate in the study of simple random sampling. The required data were collected by Food Frequency questionnaire (FFQ), anthropometric indices and physical activity questionnaire. SPSS software (version #21) was used for statistical analysis.

Results The number of coronary arteries with more than 50% stenosis was increased by high consumption of red meat ($P = 0.014$), egg ($P = 0.006$) and chicken ($P = 0.030$) and low consumption of legume ($P = 0.000$), soybean ($P = 0.002$) and vegetables ($P = 0.003$). Also, the consumption of garlic and onion was associated with a decrease in the severity of stenosis in left anterior descending (LAD) ($P = 0.036$), and right coronary artery (RCA) ($P = 0.033$). There was a significant and positive correlation among waist circumference, wrist circumference and body mass index in patients with coronary artery stenosis and a negative correlation between the height of the patient and the history of previous angiography.

Conclusion High consumption of vegetable proteins, vegetables, maintaining BMI and waist circumference in the normal range, were associated with reduced severity of coronary artery stenosis. In addition high consumption of red meat, chicken and egg is associated with higher severity and number of coronary stenosis.

Keywords Anthropometric indices · Dietary consumption · Coronary artery stenosis

Background

The prevalence of heart diseases has increased over the past two centuries and is now recognized as one of the primary causes of mortality and disability all over the world [1]. The

mortality rate caused by the disease is higher in the developed and developing countries and the reports since 2011 have shown about 17 million deaths due to cardiovascular problems in the world [2]. Now, the disease imposes high costs on the community in the form of surgery, other

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therapeutic programs, controlling complications and disability of people. It is estimated that in 2020, nearly 25 million deaths will occur a year due to heart disease in the world [3]. There are different diagnostic methods for examining patients with this disease; however, experts consider coronary angiography as one of the best diagnostic and decision making methods for the treatment of CAD [4]. Among coronary arteries, Left main (LM) Coronary Artery stenosis is an important cause of cardiovascular mortality. Common treatments for CAD include: Medical therapy, coronary artery angioplasty and coronary artery bypass graft (CABG) surgery which may be chosen for patients depending on the severity of stenosis and the number of the involved arteries [5]. Despite the high cost of treatment, many patients are frequently hospitalized [6]. In addition to genetics, a bulk of the risk factors for cardiovascular disease is rooted in environmental factors including the nutritional status of patients in the past and present [7]. According to the guidelines of the European Heart and Atherosclerosis Society (ESC / EAS) in 2016, nutritional status, healthy lifestyle, reducing extra weight, and maintaining the weight in the normal range have a main effect on reducing the risk factors for cardiovascular disease such as blood lipids, blood pressure and blood glucose levels, and consequently the prevention of cardiovascular diseases [8] which indicates the need for extensive research on determining the relationship between different factors in the spread of this disease at different ages.

One of the main groups of food pyramid is meat group including types of red meat, chicken, egg, duck, turkey, legume and soybean. The consumption of food in this group is different in traditional, western and Mediterranean diets. In the Mediterranean diet, it is recommended to monthly consume red meat, weekly chicken and fish, and daily legume and vegetable; although in western diet recommended A diet loosely defined as one high in saturated fats, red meats, ‘empty’ carbohydrates—junk food—and low in fresh fruits and vegetables, whole grains, seafood, poultry. On the contrary, traditional diet pattern is foods and dishes that are passed through generations or which have been consumed many generations. Traditional foods and dishes are traditional in nature. [9]. Some investigations indicated that a dietary pattern rich in red meat and processed meat is associated with cardiovascular disease, and the high consumption of meat can reduce the positive effects of fruits and legumes and this consequently leads to the risk of heart disease [10, 11]. According to the results of various studies, nutritional status is highly emphasized [2, 7]. Anthropometric indices such as BMI and waist circumference are also important factors in the incidence of CAD [12] [13]. Because of low knowledge, this study was conducted for determining the relationship between the type of consumed protein, vegetables and anthropometric indicators with coronary artery

stenosis in patients who were candidate for coronary artery angiography.

Methods

This descriptive-analytic cross-sectional study was carried out on cardiac patients referring to Dr. Shariati Hospital in Tehran (2016) after approval by the research council of Qazvin University of Medical Sciences with the Code of Ethics Committee No. IR.QUMS.REC.2015. The subjects who participated in this study were all cardiac patients who were candidate for coronary artery angiography by cardiologists at the hospital and they hadn’t already had coronary artery bypass surgery.

A total of 208 patients (101 female, 107 male) was included in this study of simple random sampling. We initially assigned a number to all people who were studying. Then, using random selection, 208 people were selected by software and entered the study. After completing the consent form and approving by the cardiologist, they were referred to the interviewer. Nutrition assessment was recorded in a checklist by a trained nutrition expert. The data were collected using questionnaires including: 1 - anthropometric indices (height, BMI, wrist circumference and waist circumference), 2 - FFQ that validated for Iranian population [14], 3 - demographic indices (age, gender, education, occupation, work shift, household size, history of heart disease in first degree relatives of patients and smoking) and 4 - physical activity questionnaire with reliability validity [15]. We also measured subjects’ anthropometric indices such as height, weight, body mass index ($BMI = \text{weight}/\text{height}^2$), Waist and Wrist circumference. The measurements were recorded with an approximation of 0.1 cm.

CAD was considered as diameter stenosis of at least 50% in one of the main coronary arteries or its main branches. The number of arteries with stenosis of more than 50% was considered as vessel score, which varied from zero to four. The vessel score, the severity of left main (LM), left anterior descending (LAD), left circumflex (LCX) and right coronary artery (RCA) stenosis, history of previous angiography, history of previous stenting, and appointment of patients for coronary artery bypass surgery were determined.

Statistical analyses

Data analysis was performed using SPSS software version 21 and at significance level less than 0.05. In addition, descriptive statistics and chi-square were used to examine the qualitative variables and T-test, ANOVA and multiple logistic regression were used to examine quantitative variables.

Table 1 The baseline characteristics of the participants

Variables*	Number	Minimal	Maximal	Mean $\pm$ S.D
Age (year)	208	16	81	57.81 $\pm$ 12.18
Weight (Kg)	208	45	119	74.15 $\pm$ 13.03
Height (M)	208	1	1.94	1.65 $\pm$ 0.10
Wrist circumference (cm)	208	14.5	22	18.39 $\pm$ 1.36
Waist circumference (cm)	208	64	150	97.50 $\pm$ 11.72
BMI (kg/m ²)	208	15.94	55	27.13 $\pm$ 5.18
Number of people in patients' family	208	1	13	4.30 $\pm$ 2.10
Duration of moderate and low intensity activity per week (min)	208	0	1680	92.99 $\pm$ 173.15
Duration of vigorous intensity activity per week (min)	208	0	1260	18.18 $\pm$ 99.30

BMI: Body Mass Index

*This is the results of descriptive analysis of the baseline characteristics of the participants

Results

Mean $\pm$ SD of the baseline characteristics include of age, gender, weight, height, Wrist circumference, Waist circumference, BMI, Number of people in patients' family, Duration of moderate and low intensity activity per week and duration of vigorous intensity activity per week of the participants were summarized in Table 1.

Tables 2 shows the relationship between anthropometric indices, age, physical activity and family size with coronary

artery stenosis. There was significant positive correlation between age and LAD ($r = 0.032$, $P = 0.034$). In addition correlation between age and Number of coronary arteries with stenosis of more than 50% was marginally positive significant ($r = 0.045$, $P = 0.052$). The relationship between BMI and Number of coronary arteries with stenosis of more than 50% was positive significant ($r = 0.063$, $P = 0.016$). In addition, the correlation between Waist circumference and Wrist circumference with Number of coronary arteries with stenosis of more than 50% were significantly positive that were respectively

Table 2 Correlation between anthropometric variables, age, physical activity and family size with coronary artery stenosis

Variables	Number of coronary arteries with stenosis of more than 50%	coronary artery involvement ¹				The history of previous angiography	The history of previous stenting	Candidacy for coronary artery bypass graft surgery
		LM	LAD	LCX	RCA			
Age (year)	$P^* = 0.052$ $r^* = 0.045$	$P = 0.446$ $r = 0.005$	$P = 0.034$ $r = 0.032$	$P = 0.118$ $r = 0.018$	$P = 0.228$ $r = 0.011$	$P = 0.012$ $r = 0.045$	$P = 0.013$ $r = 0.045$	$P = 0.052$ $R = 0.031$
BMI (kg/m ²)	$P = 0.016$ $r = 0.063$	$P = 0.981$ $r = 0.000$	$P = 0.960$ $r = 0.000$	$P = 0.509$ $r = 0.003$	$P = 0.920$ $r = 0.000$	$P = 0.086$ $r = 0.024$	$P = 0.925$ $r = 0.000$	$P = 0.166$ $r = 0.015$
Waist circumference (cm)	$P = 0.046$ $r = 0.050$	$P = 0.683$ $r = 0.002$	$P = 0.822$ $r = 0.000$	$P = 0.438$ $r = 0.005$	$P = 0.816$ $r = 0.000$	$P = 0.144$ $r = 0.034$	$P = 0.933$ $r = 0.000$	$P = 0.978$ $r = 0.000$
Height (M)	$P = 0.196$ $r = 0.022$	$P = 0.637$ $r = -0.002$	$P = 0.107$ $r = -0.018$	$P = 0.156$ $r = -0.014$	$P = 0.484$ $r = -0.006$	$P = 0.025$ $r = -0.042$	$P = 0.813$ $r = 0.001$	$P = 0.483$ $r = -0.004$
Wrist circumference (cm)	$P = 0.008$ $r = 0.070$	$P = 0.006$ $r = 0.070$	$P = 0.164$ $r = 0.015$	$P = 0.553$ $r = 0.003$	$P = 0.583$ $r = 0.003$	$P = 0.120$ $r = -0.022$	$P = 0.581$ $r = 0.004$	$P = 0.402$ $r = 0.006$
Duration of moderate and low intensity activity per week (min)	$P = 0.362$ $r = -0.011$	$P = 0.324$ $r = -0.011$	$P = 0.099$ $r = -0.027$	$P = 0.026$ $r = -0.034$	$P = 0.288$ $r = -0.010$	$P = 0.061$ $r = -0.051$	$P = 0.545$ $r = -0.003$	$P = 0.804$ $r = -0.001$
Duration of vigorous intensity activity per week (min)	$P = 0.399$ $r = -0.031$	$P = 0.564$ $r = -0.004$	$P = 0.560$ $r = -0.003$	$P = 0.466$ $r = -0.004$	$P = 0.040$ $r = -0.026$	$P = 0.603$ $r = -0.003$	$P = 0.592$ $r = -0.004$	$P = 0.356$ $r = -0.013$
Family size	$P = 0.080$ $r = 0.048$	$P = 0.003$ $r = 0.073$	$P = 0.020$ $r = -0.045$	$P = 0.331$ $r = -0.008$	$P = 0.032$ $r = -0.043$	$P = 0.248$ $r = -0.013$	$P = 0.732$ $r = 0.001$	$P = 0.017$ $r = -0.054$

LM, Left main; LAD, Left anterior descending; LCX, left circumflex; RCA, Right coronary artery

*This is result of correlation between qualitative variable (Severity of artery involvement) with anthropometric variables, age, physical activity and family size by T-test, ANOVA and multiple logistic regression

($r = 0.050$, $P = 0.046$) and ($r = 0.070$, $P = 0.008$). Wrist circumference and family size may increase LM involvement ($r = 0.070$, $P = 0.006$) and ($r = 0.073$, $P = 0.003$) respectively.

The relationship between dietary intakes of meat group and vegetable with coronary disease shown in Table 3. Dietary intakes of meat group foods reported in categorical qualitative amount (1 time per day, 2–3 time per week, 1 time per week and rarely) and intensity of coronary artery stenosis reported in 2 type (less than 50% and 50% and more). The consumptions of red meat ($P = 0.014$, $r = 0.156$), chicken ($P = 0.030$, $r = 0.132$) and egg ($P = 0.006$, $r = 0.179$) were associated with an increase in the number of arteries with stenosis of more than 50%. The number of arteries with stenosis of more than 50% reduced with legume and Soybean consumption ($P = 0.000$, $r = -0.914$ - $P = 0.002$, $r = -0.825$ respectively). Fish consumption ($P = 0.025$, $r = -0.139$) showed a significant negative relationship with history of previous stenting.

Relationship between demographic variables, inheritance and smoking with coronary artery stenosis were summarized in Table 4. In patients with a positive family history of coronary artery disease in close relatives (father, mother, sister and

brother), the severity of LCX artery stenosis, history of previous angiography and stenting, were higher.

Discussion

Cardiovascular disease is the leading cause of mortality and disability worldwide. Although evidence-based management of cardiovascular disease has improved outcomes, cardiovascular disease remains one of the major issues worldwide [16]. Therefore, identification of residual risk of cardiovascular disease and early risk stratification is important for more effective tailoring of risk-reduction strategies [6].

Malnutrition has been reported to be positive associated with clinical outcomes in heart failure. Thus, nutritional information could be important for risk stratification in patients with these diseases [17].

In the current study, the severity of coronary artery stenosis was increased with raising the age, body mass index and waist circumference.

Results of Nadeem et al. study [18] indicated that body mass index higher than the normal range was the most

Table 3 Relationship between protein consumption (meat group) and vegetables with coronary artery stenosis

Intensity of coronary artery stenosis dietary consumption	Number of coronary arteries with stenosis of more than 50%	LM artery stenosis	LAD artery stenosis	LCX artery stenosis	RCA artery stenosis	The history of previous angiography	The history of previous stenting	Candidacy for coronary artery bypass graft surgery
Red meat	$P^* = 0.014$ $r = 0.156$	$P = 0.136$ $r = 0.024$	$P = 0.009$ $r = 0.192$	$P = 0.576$ $r = 0.004$	$P = 0.118$ $r = 0.048$	$P = 0.132$ $r = 0.030$	$P = 0.839$ $r = 0.002$	$P = 0.053$ $r = 0.112$
Egg	$P = 0.006$ $r = 0.179$	$P = 0.059$ $r = 0.105$	$P = 0.086$ $r = 0.072$	$P = 0.246$ $r = 0.031$	$P = 0.156$ $r = 0.014$	$P = 0.661$ $r = 0.003$	$P = 0.695$ $r = 0.003$	$P = 0.005$ $r = 0.583$
Chicken	$P = 0.030$ $r = 0.132$	$P = 0.005$ $r = 0.576$	$P = 0.380$ $r = 0.008$	$P = 0.057$ $r = 0.108$	$P = 0.588$ $r = 0.005$	$P = 0.038$ $r = 0.124$	$P = 0.564$ $r = 0.006$	$P = 0.091$ $r = 0.076$
Fish	$P = 0.387$ $r = -0.008$	$P = 0.052$ $r = -0.113$	$P = 0.489$ $r = -0.006$	$P = 0.841$ $r = -0.002$	$P = 0.589$ $r = -0.005$	$P = 0.084$ $r = -0.073$	$P = 0.025$ $r = -0.139$	$P = 0.425$ $r = -0.007$
Turkey and duck	$P = 0.230$ $r = 0.033$	$P = 0.056$ $r = 0.110$	$P = 0.574$ $r = 0.006$	$P = 0.630$ $r = 0.004$	$P = 0.639$ $r = 0.004$	$P = 0.450$ $r = 0.007$	$P = 0.275$ $r = 0.018$	$P = 0.096$ $r = 0.069$
Legume	$P = 0.000$ $r = -0.914$	$P = 0.055$ $r = -0.112$	$P = 0.007$ $r = -0.199$	$P = 0.188$ $r = -0.010$	$P = 0.337$ $r = -0.008$	$P = 0.015$ $r = -0.312$	$P = 0.629$ $r = -0.004$	$P = 0.026$ $r = -0.241$
Soybean	$P = 0.002$ $r = -0.825$	$P = 0.057$ $r = -0.107$	$P = 0.052$ $r = -0.118$	$P = 0.627$ $r = -0.004$	$P = 0.841$ $r = -0.001$	$P = 0.110$ $r = -0.056$	$P = 0.500$ $r = -0.007$	$P = 0.083$ $r = -0.074$
Sausage	$P = 0.324$ $r = 0.013$	$P = 0.073$ $r = 0.084$	$P = 0.273$ $r = 0.018$	$P = 0.325$ $r = 0.012$	$P = 0.740$ $r = 0.003$	$P = 0.719$ $r = 0.004$	$P = 0.858$ $r = 0.001$	$P = 0.592$ $r = 0.005$
Organ Meat	$P = 0.459$ $r = 0.006$	$P = 0.050$ $r = 0.112$	$P = 0.406$ $r = 0.007$	$P = 0.547$ $r = 0.005$	$P = 0.659$ $r = 0.004$	$P = 0.180$ $r = 0.013$	$P = 0.101$ $r = 0.098$	$P = 0.536$ $r = 0.005$
Vegetables	$P = 0.003$ $r = -0.798$	$P = 0.052$ $r = -0.118$	$P = 0.027$ $r = -0.133$	$P = 0.255$ $r = -0.034$	$P = 0.127$ $r = -0.032$	$P = 0.000$ $r = -0.937$	$P = 0.081$ $r = -0.75$	$P = 0.156$ $r = -0.042$
Raw garlic and onions	$P = 0.102$ $r = 0.059$	$P = 0.063$ $r = 0.107$	$P = 0.036$ $r = 0.124$	$P = 0.297$ $r = 0.012$	$P = 0.033$ $r = 0.267$	$P = 0.765$ $r = 0.003$	$P = 0.813$ $r = 0.002$	$P = 0.053$ $r = 0.118$

LM, Left main; LAD, Left anterior descending; LCX, left circumflex; RCA, Right coronary artery

*The relationship between Dietary intakes of meat group foods reported in categorical qualitative amount (1 time per day, 2–3 time per week, 1 time per week and rarely) and intensity of coronary artery stenosis reported in 2 type (less than 50% and 50% and more)

* P value obtained from Spearman correlation

Table 4 Relationship between demographic variables, inheritance and smoking with coronary artery stenosis

Variables	Number of coronary arteries with stenosis of more than 50%	coronary artery involvement				The history of previous angiography	The history of previous stenting	Candidacy for coronary artery bypass graft surgery
		LM	LAD	LCX	RCA			
Sex [*]	$P=0.673$	$P=0.259$	$P=0.658$	$P=1$	$P=0.628$	$P=0.243$	$P=0.835$	$P=0.613$
Married [*]	$P=0.868$	$P=0.204$	$P=0.453$	$P=0.631$	$P=0.579$	$P=0.763$	$P=0.132$	$P=0.139$
Patient's education ^{**}	$P=0.340$ $r=-0.010$	$P=0.141$ $r=-0.112$	$P=0.087$ $r=-0.172$	$P=0.545$ $r=-0.006$	$P=0.172$ $r=-0.086$	$P=0.133$ $r=-0.121$	$P=0.199$ $r=-0.059$	$P=0.702$ $r=-0.003$
Spouse's education ^{**}	$P=0.111$ $r=-0.146$	$P=0.059$ $r=-0.198$	$P=0.581$ $r=-0.005$	$P=0.067$ $r=-0.192$	$P=0.721$ $r=-0.003$	$P=0.681$ $r=-0.004$	$P=0.156$ $r=-0.102$	$P=0.135$ $r=-0.129$
Occupation [*]	$P=0.751$	$P=0.003$	$P=0.513$	$P=0.526$	$P=0.653$	$P=0.142$	$P=0.862$	$P=0.749$
Work shift [*]	$P=0.074$	$P=0.028$	$P=0.073$	$P=0.209$	$P=0.149$	$P=0.057$	$P=0.068$	$P=0.598$
History of heart disease in close relatives [*]	$P=0.145$	$P=0.296$	$P=0.058$	$P=0.044$	$P=0.481$	$P=0.000$	$P=0.008$	$P=0.031$
Smoking ^{**}	$P=0.226$	$P=0.337$	$P=0.128$	$P=0.707$	$P=0.297$	$P=0.021$	$P=0.033$	$P=0.274$

LM, Left main; LAD, Left anterior descending; LCX, left circumflex; RCA, Right coronary artery

*The differences between sex and Marriage with coronary artery stenosis by Chi-Square

**P value is relationship between demographic variables, inheritance and smoking obtained from Spearman correlation

prevalent risk factor in patients with CAD. Also, these results have been shown in maroszynska [19] Bidel [20] studies. In the study that done by Bose et al., the relationship between waist circumference and CAD was emphasized because the waist circumference can be an indicator for determining the total body fat [21]. In their investigation, BMI was evaluated in cardiovascular patients. They found that with an increase in BMI, the clinical factors of ischemic heart and hypertensive patients would be in poor condition. So they illustrated that BMI may be a control indicator of risk factors [22]. In the guidelines of the American Heart Association (AHA), for reducing the risk of cardiovascular disease, weight should be within the normal range [23]. According to the results of Schmidt investigation, short height can be a risk factor for cardiovascular disease [24]. Also, results of Miedema [25] and Akinkuolie [26] studies indicated that, there was an inverse relationship between the height and heart failure, while Asghari et al., the study indicated that after adjusting the age variable there was no correlation between height and CAD in men and women [27].

In the present study, with an increase in the wrist circumference, the number of arteries with stenosis of more than 50% and the severity of LM coronary artery stenosis increased. In the study done by Hajsadeghi, the wrist circumference was significantly higher in patients with coronary artery stenosis compared to healthy subjects [28]. Also, wrist circumference has been known as a predictor for the thickness of the radial artery, according to Aykan investigation [29], but 9 years of follow-up in the population with a high prevalence of risk factors for CAD, higher wrist circumference related to lower risk of CAD in the study of Derakhshan [30]. This positive

correlation may be associated with insulin resistance in higher wrist circumference [28–30].

Meat and vegetable groups are the main groups of the food pyramid and the amount of their consumption is related to different diseases [9, 16, 17]. In the present study, in patients with the lowest consumption of animal protein (red meat, chicken, and egg) and appropriate consumption of fish and plant proteins (legume and soybean), the intensity of coronary artery stenosis, being a candidate for coronary artery bypass surgery and history of previous angiography were less prevalent. In this study, there was no significant relationship between the consumption of turkey, sausage and organ meat with coronary artery stenosis due to the low consumption in most patients.

According to the results of Ralph study, the Mediterranean diet (low consumption of red meat but high consumption of vegetables and legume) was associated with a reduction in the incidence of cardiovascular events [9]. Some researchers believe that the Mediterranean diet has a protective effect on the prevention of cardiovascular disease [31], although, in some studies, there was no significant protective relationship between the Mediterranean diet and the risk of myocardial infarction [32, 33]. It has been indicated that the food pattern with high consumption of legumes and vegetables and low consumption of red and processed meat has few effects on the secondary prevention [33]. High consumption of meat reduces the positive effects of fruits and legumes on reducing the risk of heart disease [10, 11, 17] while in the study by Clifton, there was no relationship between common consumption of meat and heart disease [16].

Several important nutrients are in fish, but their main cardiovascular advantage likely arises from their content of the omega-3 fatty acids, Eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). This benefit appears to be linked to the enrichment of membrane phospholipids with omega-3 fatty acids and a causing decrease in risk for abnormal cardiac electrical conductivity [34].

According to the study by Bernstein, along with the changes in protein sources from red meat to fish, poultry, and legumes the risk of CAD reduced [35]. In the study done by Pounis and Zampelas, the consumption of fish was associated with the reduction in the incidence of acute coronary syndrome and inflammatory blood factors [36, 37].

The results of the present study showed that along with an increase in the consumption of vegetables, coronary artery stenosis and the history of previous angiography decreased. In various studies, the consumption of vegetables has been emphasized [10, 11, 16] and cardiovascular disease reduction has been observed along with increasing the consumption of vegetables [9, 16, 17]. In contrast, in the study done by Kohpayezadeh et al., there was no significant difference between the patients and subjects of control groups in terms of the consumption of vegetables and legumes [34]. In a meta-analysis done by McEvoy et al., there was no relationship between the consumption of vegetables and risk factors for cardiovascular disease in obese adults with a high risk of heart disease [38]. In this study, the consumption of garlic and onion decreased the severity of RCA and LAD coronary artery stenosis. Investigations illustrated the anti-atherosclerotic, anti-inflammatory, antioxidant and blood lipids- lowering properties of garlic and onion [39, 40]. Onion is rich in flavonoids which have anti-atherosclerotic properties [40]. The American Heart Association has focused on increasing the consumption of vegetables, poultry, fish, legumes and reducing the consumption of red meat in order to reduce the risk of cardiovascular disease and proposed using dietary patterns, including the American Heart Association (AHA) diet, United States Department of Agriculture (USDA), Dietary Approaches to Stop Hypertension (DASH) [23].

In the present study, coronary artery stenosis was less in moderation-populated families and non- rotating jobs, especially morning shift. The results of some studies such as the study done by Burgueno et al., emphasizes the relationship between shift jobs as a risk factor for CAD, atherosclerosis and myocardial infarction [41]. In contrast, in the study done by Kantermann et al., there was no relationship between work shift and cardiovascular disorders [42].

In this study, along with an increase in the history of heart disease in close relatives, smoking and a decrease in the amount of moderate and low intensity activity and vigorous intensity activity per week, the intensity of coronary artery stenosis increased. In the recommendations of the American Heart Association, the increase in physical activity has been

emphasized for the prevention and control of cardiovascular diseases, including CAD, consequently, 150 min of moderate aerobic exercise or 75 min of high intensity aerobic exercise per week have been recommended [23].

Conclusion

In summary, according to the results of the present study, maintaining a proper range of BMI and waist circumference, less wrist circumference, tall height, replacing animal proteins (red meat, chicken and eggs) with plant proteins (Legumes and soybeans) and increasing the consumption of fish and vegetables, especially garlic and onions are associated with the reduction in the number and severity of coronary artery stenosis.

Limitation

Our study had some limitations, including the cross-sectional nature of the study and using FFQ questionnaire because the evaluation of dietary consumption of the Food Frequency questionnaire includes some errors such as more or less reporting on a number of dietary items.

The strengths of this study is in controlling the effect of confounding variables such as smoking, physical activity, inheritance, level of education, occupation and the work shift of patients because CAD is a multiple-cause illness.

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Compliance with ethical standards

Conflict of interest The authors declared that they have no conflict of interest.

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