ORIGINAL ARTICLE

Correlation between Dietary Inflammatory Index (DII) and Neck Circumference (NC) in Coronary Artery Disease Patients

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Abstract

Background: Inflammation, a risk factor for cardiovascular disease (CVD), is affected by diet.Dietary inflammatory index (DII) is used to determine inflammation of diet. In addition, Neck circumference (NC), an indicator for upper-body subcutaneous adipose tissue distribution, is related to cardiovascular risk factors. This study aimed to examine the correlation between DII and NC in a nationally representative sample case and control.

Methods: In this cross-sectional study, the case group was chronic heart disease patients hospitalized in Al-Zahra Heart Clinic, Shiraz, Iran (N=100). The Control group did not suffer from any heart-related diseases. Dietary intake data were determined using a single interview and food frequency questionnaire (FFQ). NC was assessed using standard methods. Nutritionist-4 software was used to analyze nutrient intakes from FFQ. The method of Shivappa et al. was used to calculate DII.

Results: The mean of NC in the case and control group were 39.09±4.18 and 36.68±4.32 cm. The mean of DII in the case and control groups were -0.018±1.53 and 0.40±155. There was no significant difference between the DII score of the case and control groups (P=0.056, t=-1.922). No significant correlation was observed between DII score and NC in the case (P=0.750,r=0.032) and control (P=0.294, r=0.106) groups.

Conclusion: There was no correlation between DII score as a risk factor for CVD and NC in both case and control groups.

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Keywords: Coronary artery disease, Cross-sectional study, Dietary inflammatory index, Metabolic syndrome, Neck circumference

Introduction

Inflammation is a usual biological process that is needed for body function. It plays a significant role in host defenses against infections, but it also results in the pathophysiology of various chronic diseases. Interactions involving cells in the innate and adaptive immune system and inflammatory mediators integrate acute and chronic inflammationthat may lead to different diseases.[1]

As one of the most important chronic diseases, cardiovascular disease is associated with chronic inflammation.[2] unimproved chronic infections or unhealthy lifestyles such as unhealthy diet and tobacco addiction can cause chronic inflammation.[1] As a risk factor for various chronic diseases, systemic inflammation is strongly influenced by dietary components.[3, 4]

Unhealthy eating patterns high in fat, refined carbohydrates, and protein lead to higher levels of inflammation, while some healthy diets, such as Mediterranean diets, are associated with a lower degree of inflammation.[5] In assessing dietary

inflammation, it should be noted that foods are not eaten alone but are consumed in combination.[6, 7] Therefore, the dietary inflammatory index (DII)is a practical tool that classifies dietary intake from anti-inflammatory to pro-inflammatory and assesses the diet's overall inflammatory potential.[6]

Researchers have developed DII to state the inflammatory capacity of the diet based on the total inflammatory properties of dietary components, such as vitamins and minerals, macronutrients, flavonoids, and other bioactive components.[6] Cardiovascular Diseases (CVD) are the leading cause of death worldwide, according to the World Health Organization (WHO). Therefore, the primary purpose of screening CVD's risk factors, including inflammation,[3] metabolic syndrome, and obesity, is to prevent the disease.[8]

Obesity, as a component of metabolic syndrome, is a significant risk factor for cardiovascular diseases (CVD).[9] In addition, body fat distribution is one of the primary aspects of metabolic syndrome. Patterns of fat distribution, especially upper body adiposity, are associated with a higher risk of CVD than lower body obesity.Furthermore, upper body adiposity strongly involves with glucose intolerance, hyperinsulinemia, diabetes, and hypertriglyceridemia. Neck circumference (NC), an indicator of upper subcutaneous adipose tissue distribution, is related to cardiovascular risk factors.[10, 11] Therefore, it can be considered a valid indicator for identifying obese individuals with a high correlation with other anthropometric measurements. The correlation between NC and cardiometabolic risk factors is higher than other obesity criteria.[12, 13]

NC is a reliable, non-invasive, practicable and straightforward method of obesity and body fat distribution,[8] it is considered a CVD risk predictor.[14] It has been observed that people with higher NC are more vulnerable to CVD.[15] Several studies investigated the correlation between dietary inflammatory index (DII) and anthropometric measurements.[3, 16, 17] However, there is no research investigating the correlation between DII score and neck circumference as a novel indicator of CVD. Therefore, we examined the correlation between dietary inflammatory index scores, as a risk factor for CVD and neck circumference, as a valid anthropometric index that predicts CVD.

Methods

Ethical Considerations

The Medical Research Ethics Committee of Shiraz university of medical sciences approved this study (No: IR.SUMS.REC. 1400.100), and all participants entered the study with their consent and voluntarily.

Participants

In this cross-sectional study, the researchers selected 100 patients with CHD hospitalized in the coronary artery disease ward in Al-Zahra Heart Specialist Clinic, located in Shiraz, Iran, from May 2019 to July 2019. The control group included 100 healthy people who did not have any heart-related diseases. The samples were selected by convenience sampling.

The sample size in a cross-sectional design is calculated using the formula. First, the sample of 100 was calculated based on the weight parameter in the previous study,[18] where Z1 and Z2 for the confidence level of 0.95 and test power of 0.8 from the normal distribution table were equal to 1.96 and 0.84, respectively. According to Cohen's definition, d=0.5 σ means moderate differences. A simple random sampling technique was then applied to select study participants, using the table of random numbers and computer.

Inclusion Criteria

- People with coronary artery disease hospitalized in Alzahra Heart Specialist Hospital in Shiraz from May 2019 to July 2019 as a case group.
- People without a history of cardiovascular disease as a control group.
- People who can talk and respond.
- People who have not followed a special diet during last year.
- People who do not have dementia.
- People who do not have other specific diseases (cancers, liver-kidney diseases, autoimmunity, etc.)
- People willing to participate in a research project

Exclusion Criteria

- People who expressed reluctance to continue their cooperation
- Consumers of dietary supplements and medications apart from those taken for the heart disease
- People diagnosed with certain diseases or malignancies

Data Collection

Dietary intake data were collected by food frequency questionnaire (FFQ) with 168-food items developed for the Tehran Lipid and Glucose Study. Its reproducibility and relative validity have already been evaluated.[19]

Height, weight, BMI, and some anthropometric indexes, including wrist and NC, were assessed using standard methods. Wrist and NC were measured by non-stretchable plastic tape. NC was measured in the midway of the neck, between the mid-cervical spine and the mid anterior neck, with the head positioned in Frankfurt horizontal plane. Demographic data, including gender, age, job, education, marital status, and smoking history, were gathered by interviewing the trained staff. To assess people's physical activity, we asked them how many days a week they exercise?

Then we classified them accordingly.

Nutritionist-4 software was used to analyze nutrient intakes from the food frequency questionnaire; then, these dietary data were used to calculate DII. Finally, the method of Shivappa et al. was used to calculate DII.[6] According to this method, dietary intake of nutrient and non-nutrient components is calculated and compiled into a Dietary Inflammatory index.[18]

Statistical Analysis

SPSS software (version 24.0) was used to perform the data analysis.

Descriptive statistics, including sex, smoking status, exercise status, age, BMI, BMI classification, neck and wrist circumference, and some other demographic factors, were conducted with chi-square tests for categorical variables and Pearson test for continuous variables. Pearson correlation coefficient was used to evaluate the DII and neck circumference association. In addition, an independent sample T-test was used for comparing the mean of DII between the case and control groups. Results were considered significant if the P value of the analysis was <0.05.

Results

In this study, 200 people were enrolled. Of these, 97 (48.5%) are men and 103 (51.5%) are women. Among all the participants (case: n=100 (50.0%), control: n=100 (50.0%)), the average of the case and control groups' BMI were 26.37±4.9 and 26.98±5.05, respectively. The mean of NC in the case group was 39.09±4.18 and in the control group was 36.68±4.32 cm. The mean of DII in the case group was -0.018±1.53 and in the control group was 0.40±155.

Chi-square test showed no difference in sex (P=0.089, value=3.383), education (P=0.274, value=5.166), marital status (P=0.134, value=3.191), and physical activity (P=0.597, value=1.879) between the case and control groups. The chi-square showed a positive correlation between the health status (being in case or control group) and smoking (P=0.037, value=5.181).

Chi-square showed no significant difference between BMI classification in the case and control groups (P=0.839, value=1.529).

Independent sample t-test showed that the DII score was not different between case and control groups (P=0.056, t=-1.922).

Pearson correlation was performed to test the correlation between DII score and neck circumference, and no significant correlation was observed in both cases (P=0.750, r=0.032) and control (P=0.294, r=0.106) groups.

Table 1 shows the participants' characteristics by Dietary Inflammatory Index (DII) tertiles.

Discussion

As mentioned earlier, there was no significant difference

Table 1: Participants' characteristics by Dietary Inflammatory Index (DII) tertiles

	Total	DII Tertile 1	DII Tertile 2	DII Tertile 3	P value
Age	60.88±11.45	60.48±9.53	60.77±11.85	61.35±12.85	0.906
Height (cm)	163.89±9.55	164.90±10.20	162.53±9.30	164.23±9.11	0.341
Weight (kg)	71.64±14.58	74.44±15.39	68.93±13.76	71.54±14.25	0.094
Neck circumference (cm)	37.81±4.43	38.29±4.73	3.19±4.19	37.95±4.36	0.347
Wrist circumference (cm)	17.77±2.13	18.44±2.74	17.06±1.59	17.82±1.65	0.001
BMI	26.68±4.99	27.36±4.92	26.03±4.60	26.64±5.40	0.312
Sex					0.131
Male	97 (48.5%)	32 (48.5%)	26 (39.4%)	39 (57.4%)	
Female	103 (51.5%)	34 (51.5%)	40 (60.6%)	29 (42.6%)	
Marital status					0.10
Yes	188 (93.9%)	65 (98.5%)	61 (89.7%)	188 (94.0%)	
No	12 (6.0%)	4 (6.1%)	1 (1.5%)	7 (10.3%)	
Smoking					0.757
No	173 (86.5%)	56 (84.8%)	59 (89.4%)	58 (85.3%)	
Yes	27 (13.5%)	10 (15.2%)	7 (10.6%)	10 (14.7%)	
Currently dieting					0.087
No	182 (91.0%)	56 (84.8%)	63 (95.55%)	63 (92.6%)	
Yes	18 (9.0%)	10 (15.2%)	3 (4.5%)	5 (7.4%)	
Education					0.001
Illiterate	76 (38.0%)	16 (24.2%)	27 (40.9%)	33 (48.5%)	
5 years of school	30 (15.0%)	11 (16.7%)	7 (10.6%)	12 (17.6%)	
8 years of school	24 (12.0%)	3 (4.5%)	10 (15.2%)	11 (16.2%)	
Pre-university	43 (21.5%)	20 (30.3%)	17 (25.8%)	6 (8.8%)	
+4 years of college	27 (13.5%)	16 (24.2%)	5 (7.6%)	6 (8.8%)	
Coronary artery disease					0.06
Yes	100 (50.0%)	37 (56.1%)	37 (56.1%)	26 (38.2%)	
No	100 (50.0%)	29 (43.9%)	29 (43.9%)	42 (61.8%)	

Values are expressed as mean±standard deviation (SD). BMI: body mass index

between BMI classification or DII score in both case and control groups. Furthermore, the present study showed no significant correlation between the tertiles of DII scores and NC in adults.

It is worth considering that there are few studies on the relationship between overweight and obesity and DII. In some studies,[20-22] the association between the DII with obesity and anthropometric measurements has been shown. However, the present study showed no significant difference between DII scores and BMI. Similar to the result of the present study, Correa-Rodríguez et al. reported that the inflammatory potential of diet (DII) is associated with obesity-related parameters such as fat-free mass and weight, but not with BMI and fat mass in adults.[23] In contrast with the present study, Vahid et al. showed the association between DII and BMI in male adolescents. It can be due to the difference in the age of the participants. Therefore, it seems that DII may be more effective on obesity-related traits during childhood and adolescence. Based on the previous studies and proposed mechanisms, overweight and obesity are related to low-grade inflammation, resulting from chronic activation of the innate immune system, which can subsequently lead to IR and impaired glucose tolerance.[24]

To the best of our knowledge, the present study is the first study that examined the association between NC and dietary-induced inflammation in obese individuals.

There has been no study investigating the association between NC as a potential indicator for measuring central obesity and DII. The present study showed no significant difference between the tertiles of DII scores and NC. However, in comparison to BMI, NC has some strong points due to the high heterogeneity, so clarifying its efficacy needs more studies. Therefore, NC may not be a good indicator to predict obesity.

Whereas obesity is a risk factor for cardiometabolic disease,[25] the association between body mass index (BMI), waist circumference (WC), and waist-to-hip ratio (WHR) as indices of general or central obesity and increased cardiometabolic risk has been demonstrated in several studies.[25, 26] However, BMI and WC have been used traditionally as indices for general and visceral obesity, respectively,[27, 28] but both assessments have their limitations. BMI does not account for body fat distribution and cannot distinguish between lean and fat mass, while WC requires that participants dress minimally, do not eat before the measurement, and have an empty bladder.[29-31]

However, NC is an easy, constant, and time-saving measure to identify overweight and obese individuals.[32, 33] It has also been s a tool associated with central obesity,[34] hypertension, and other components of metabolic syndrome (MetS).[35] Therefore, specifically for epidemiological assessment, NC seems to be predictive for diagnosing some cardiometabolic risk factors.[36] The mechanisms that describe the correlation between neck adipose tissue and cardio-metabolic risk factors are not accurately identified.[36]

High plasma free fatty acids (FFAs) likely provide a ground for developing metabolic disorders.[37] In addition, increasing the levels of FFAs can result in increased inflammatory factors, oxidative stress, and vascular injury.[37, 38] Also, NC is a good predictor for the risk of sleep apnea syndrome, while sleep apnea syndrome is also associated with cardiovascular diseases.[39]

The main releasing rate of systemic FFA is dedicated to upper body subcutaneous fat.[33, 37]

There were some notable findings relating the DII to various Education Illiterate. Participants with less education (school education) had more pro-inflammatory diets than those with higher education (4+ years of college). In agreement with the present study, Wirth et al. showed a relation between the DII and various sociodemographic or psychosocial constructs. Females, participants with higher education (4+ years of college), had more anti-inflammatory diets.[3] Furthermore, using the HEI-2005, two US studies also indicated better dietary quality among females, especially those with higher education.[40, 41]

Some limitations of the present study should be acknowledged. First, there was a high heterogeneity among studies analyzing NC. Moreover, information bias could result from using the FFQ for dietary assessment. Therefore, misclassification is a potential problem common in epidemiologic reports. Second, due to an inadequate sample size, the study is not adequately powered.

Conclusion

In conclusion**,** the present investigation observed no significant difference between pro-inflammatory diet scores (DII scores) and more significant indices of BMI and NC in adults. However, prospective studies are needed to investigate this relationship.

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Conflicts of interest*:* None declared.

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