Association of Dietary Inflammatory Index with Cardiovascular Disease in Kurdish Adults: Results of a Prospective Study on Ravansar Non-Communicable Diseases

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Abstract

Background and aim Various diets and dietary compounds, through their inflammatory properties, are involved in the pathogenesis of chronic diseases including cardiovascular diseases (CVDs). Dietary Inflammatory Index (DII) can evaluate the inflammatory properties of diet. The purpose of this study was to determine the association between DII and CVDs in participants of the Ravansar non-communicable diseases (RaNCD)cohort study, Kermsnahsh, Iran.

Materials and methods The present cross-sectional study was conducted using the recruitment phase data of the RaNCD cohort study on 6369 participants aged 35 to 65 years. The Food frequency questionnaire (FFQ) was used to assess diet. The DII scores were calculated using FFQ data. Participants with a history of myocardial infarction, stroke and coronary artery disease, and/or taking medications for the CVDs were considered as the CVDs patients.

Results Of the 6369 studied participants, 9% (n=579) had CVDs history. The mean DII score in this study was -0.84±1.6. Odds ratio (OR) of CVDs in female was 1.6 times higher than in male (CI 95%=1.3-1.9), which this association was remained after adjusting for confounding variables (OR=1.5, CI%=1.2-1.9). The risk of CVDs in the fourth quartile of DII was 1.4 times higher than the first quartile of DII (OR: 1.4, CI 95%=1.1-1.8). We found that higher adhere to DII was associated with risk of CVDs.

Conclusion Given the role of diet through inflammatory properties on the risk of CVDs, it is highly recommended to use DII as an appropriate index to measure the effect of diet on CVDs. In addition, a diet with lower DII is more healthy diet for cardiovascular health.

Abbreviations

DII: Dietary Inflammatory Index

CVDs: Cardiovascular Diseases

BMI: Body Mass Index

HTN: Hypertension

MI: Miocardial Infraction

CRP: C-Reactive Protein

IL: Interleukin

hs-CRP: High Sensitivity CRP

RaNCD: Ravansar Non-Communicable Diseases

PERSIAN: Prospective Epidmiologic Research of IRAN

FFQ: Food Frequency Questionnaire

TNF-α: Tomor Necrosis Factor-α

FBS: Fasting Blood Sugar

LDL: Low Density Lipoprotein

HDL: High Density Lipoprotein

TG: Triglyseride

AHEI: Alternative Healthy Eating Index

a MED: alternative Meditterranean Diet Score

Introduction

Cardiovascular diseases (CVDs) are the leading cause of mortality in the worldwide [1, 2], the most important cause of disability, and a decline in quality of life [3]The global prevalence of CVDs has increased, especially in high-income countries, with nearly 18 million people (about one-third of all deaths) worldwide in 2015 and approximately one million in North Africa and the Middle East lost their lives due to CVDs [4]. It is predicted that the CVDs, especially myocardial ischemia and stroke, will cause approximately 25 million deaths by 2030 [2]. The burden of CVDs in low- and middle-income countries, including Iran, has become a widespread challenge in these countries [3]. As in many West Asian countries, the CVDs is the first cause of death in Iran, accounting for 46% of all deaths in 2015. In addition, the prevalence of CVDs risk factors is high in West Asia, including Iran, with the mean cholesterol and body mass index (BMI) in both sexes and hypertension (HTN) in Iranian women higher than the world average [4].

Cohort studies suggest an association between systemic inflammation and CVDs as well as its related mortality [5]. Atherosclerosis is the leading cause of CVDs [2]. Studies show that chronic inflammation not only plays an important role in the pathogenesis and progression of atherosclerosis [2, 6], but also induces thrombosis as one of the complications of atherosclerosis, the cause of myocardial infarction (MI) and most strokes [7]. One of the risk factors for CVDs is dietary pattern or diet. Since the diet is both effective in chronic diseases [2] and can be modulatory to inflammatory conditions [7, 8], it can therefore act as a mediator between chronic diseases including CVDs and chronic inflammation. Traditional diets, such as Mediterranean diets rich in fruits and vegetables, whole grains, olive oil and low amounts of refined grains and processed foods, are good sources of inflammation-modulating nutrients [8, 9]. Diet has been associated with reduced CVDs risk as well as lower C-reactive protein (CRP) levels [7]. In contrast, Western diets that are rich in refined grains, simple carbohydrates, fats, and high-fat dairy are associated with increased levels of inflammatory markers including CRP and Interleukin–6 (IL–6) [7, 10].

Since nutrients are not consumed on their own and overlap with their potential benefits or disadvantages, analyzing dietary patterns and assessing the overall inflammatory potential of the diet are useful approaches to assess the association between diet and chronic disease risk [6, 11]. Dietary Inflammatory Index (DII) is an indicator for assessing the inflammatory potential of a person’s diet [12]. The validity of DII has been investigated with two dietary evaluation methods, which have shown that the DII is capable of predicting hs-CRP -This test accurately measures the low level of C-reactive protein. hs-CRP can be used to detect the risk of cardiovascular disease- concentration with a cut-off point of values less than or equal and greater than 3 mg/l. A high score of DII (proinflammatory diet) is associated with hs-CRP higher than 3 mg/l [13]. In recent years, several studies have been conducted on the association between chronic inflammation, diet, and CVDs [2, 14], but since different diet and dietary habits exist in different societies, and especially in various ethnicities and races, specific studies in ethnic subgroups can accordingly provide appropriate evidence regarding the planning and design of preventive interventions in relation to the CVDs. This study is one of the first studies on a significant population of Kurdish people in Iran. The current study aimed to determine the association of DII with CVDs in Kurdish adults.

Materials And Methods

Study design

The present cross-sectional study has been adapted from data from the initial phase of a prospective study on Ravansar non-communicable diseases (RaNCD). The RaNCD cohort study is a part of a prospective epidemiologic research in Iran (PERSIAN) being conducted on different ethnic groups in coordination with the Ministry of Health and Medical Education. Ravansar, with a population of about 50,000, is one of the Kurdish settlement in Kermanshah. Population homogeneity of the city in terms of ethnic diversity, ease of access and relative stability of population in terms of migration in the city is one of the most important reasons for choosing this city as one of the PERSIAN cohort sites in the country. The preliminary phase of the study began in November 2014 and ended in February 2017, during which 10065 individuals signed the informed consent to participate in the study and enrolled in the study. Further details of the RaNCD study have already been published [15, 16].

This study has been approved by the Department of Research and Technology (grant: 980352) and by the Ethics Committee of Kermanshah University of Medical Sciences (code of ethics of KUMS.REC.1394.315).

Inclusion and exclusion criteria

Inclusion criteria were: participants with a baseline CVDs data that participated to the RaNCD cohort study. For the purpose of this study, participants with renal failure and kidney stones}(n = 1357), cancer (n = 93) liver disease (n = 817), thyroid disease (n = 727) and inflammatory diseases (n = 310), pregnant women (n = 88) and those with missed information (n = 304) were not included to this study. Finally, out of 10065 participants in RaNCD cohort study, 6369 persons (3223 men and 3146 women) were included.

Data collection

In RaNCD cohort study, demographic data including age, sex, marital status, educational level, socioeconomic status and smoking were collected through a questionnaire. The PERSIAN Cohort standard physical activity questionnaire was used to assess participants' physical activity. The questionnaire consisted of 22 questions about the extent of individual activity during the circadian cycle. Answers to these questions were recorded in the questionnaire in hours or minutes per day. Finally, questionnaire information was extracted and used based on met/hour per day.

Dietary assessment and DII

The standardized 137-item 1-year food frequency questionnaire (FFQ) of PERSIAN cohort study was completed to evaluate the diet. Frequency of consumption and size of common share were considered for each food item. Updated dietary databases were used to calculate the amount of nutrient intake [16, 17]. The FFQ was used to calculate DII. The method for calculation of DII has been described in various reports [2, 18]. The DII was suggested by reviewing articles published between 1950 and 2010 on the association between a variety of dietary parameters and 6 inflammatory markers (IL−1β, IL−4, IL−6, IL−10, CRP and TNF-α). Accordingly, 45 dietary parameters, including macronutrients, micronutrients, flavonoids and other food items, have been identified that can have inflammatory effects. The inflammatory potential of each parameter was assessed by their effect on increasing, decreasing or not affecting the levels of these inflammatory markers. If each of these food items increased the levels of inflammatory markers, they would score +1, if they decreased the levels of inflammatory markers, they would score −1, and if they had no effect on the levels of inflammatory markers, they would receive an inflammatory score of 0. The DII score can

range between −8.87 (the highest anti-inflammatory score) and + 7.98 (the highest pro-inflammatory score). On the basis of mean intake and global standard deviation, Z-score was determined for each parameter. Then, the Z-score became a percentile. The inflammatory score for each of the dietary parameters was calculated by this manner, and then the inflammatory score of all parameters was summed to calculate the total DII score. The more negative the DII score, the more powerful anti-inflammatory property and the more positive values, the more powerful pro-inflammatory characteristics [6, 19].

Definitions and measurements

According to the RaNCD study protocol, the CVDs participants are people with a history of hospitalization and/or treatment for one or more heart diseases such as stroke, MI and coronary artery disease, and/or taking medications for the CVDs. Diagnosis of type II diabetes includes fasting blood sugar (FBS) levels equal to or greater than 126 mg/dl and/or treatment with hypoglycemic drugs. Also, subjects with systolic blood pressure equal to or greater than 140mmHg and diastolic blood pressure equal to or greater than 90 mmHg, and/or those treated with blood pressure lowering medications were considered as subjects with HTN. In this study, dyslipidemia was also considered to be a disorder of serum lipid profile indices including one or more of the following: LDL> 130 mg/dl, HDL <45 mg/dl, TG> 150 mg/dl, Total Cholestrol> 200 mg/dl and/or taking blood lipid lowering medications including amlodipine, atorvastatin, clofibrate, fenofibrate, gemfibrozil, lovastatin and simvastatin [16].

The wealth variable was measured, using 15 items (including housing, car, washing machine, dishwasher, Freezer, computer, internet access, motorcycle, car rental, car type, vacuum cleaner, color TV, TV type, bathroom, cell phone) by PCA method. wealth was also categorized into five groups, from the poorest to the richest.

Statistical analysis

The association between variables was evaluated using univariate and multivariate logistic regression models. Variables with p<0.3 in univariate analysis were entered into multivariate model. Then, variables with p-value> 0.05 were removed using forward or backward method. The fractional polynomial method was performed to quantitatively associate the effect of DII on prevalence of CVDs. In this method, the effects of demographic variables and BMI on CVDs were first adjusted. The effect of DII was then evaluated. The fractional polynomial is a regular polynomial alternative method that provides flexible parameterization for continuous variables. All analyzes were performed using Stata version 14.1 software (StataCorp., College Station, TX, USA) with 95% confidence interval.

Results

Of the 6369 studied, 3223 (50.6%) were male. The mean age of participants was 46.9±8.4 years and 46.21% of participants were in the age group of 35–45 years. Almost 90% of participants were married and the majority (56.63%) was urban. The mean energy intake in the participants was 3010±1039.9 kcal/day, 58.65% of which was carbohydrate and this difference was statistically significant in different quartiles of DII (P<0.001). The mean energy intake in the first quartile was significantly higher than the fourth quartile of DII (P<0.001). The mean carbohydrate energy in the fourth quartile was significantly higher than the first quartile of DII. However, the mean energy of protein and fat in the first quartile of DII was significantly higher than the fourth quartile. Of the total population, 26.1% of participants had low physical activity, which was significantly different in the different quartiles of DII (P<0.001). Most people with high physical activity were in the Q1 (the most powerful anti-inflammatory diet).

The prevalence of CVD in the present study was 9.09%, and its prevalence in first to fourth quarters was 22.45%, 21.42%, 23.49% and 32.64%, respectively (P<0.05).

Moreover, 35.8% of women were in the highest quartile of DII (the most powerful pro-inflammatory diet), while only 14.15% of men were in this quartile. People with higher educational level had a lower DII than those with lower educational level. People with the highest socioeconomic status had a significantly lower DII (P<0.001) than those with the lowest level. Additionally, 13.94% of the studied subjects had HTN and these individuals had significantly higher DII than those who had no HTN (P<0.001). Furthermore, 43.38% of the subjects had dyslipidemia, most of whom (26.9%) were in the fourth quartile of DII. Approximately 7.44% of the subjects had diabetes; there was no significant difference in the DII score between the two groups with and without diabetes (P = 0.795) (Table 1).

The mean DII score in this study was −0.84±1.6 and the DII score ranged from −4.5 (the most powerful anti-inflammatory diet) to + 4.6 (the most powerful pro-inflammatory diet).

DII and CVD risk

The odds ratio of CVDs was 1.6 times higher in females than in males (CI = 1.3–1.9) and remained significant after adjusting for confounding variables (OR = 1.5, CI = 1.2–1.9). The odds ratio of CVDs increased with age, so that it was 3.2 times in the age group of 46–55 years (CI = 2.4–4.1) and 8.6 times in the age group of 56–65 years (CI = 6.7–11.0) higher than in the age group of 35–45 years, and this association was significant after adjusting the confounding variables.

Those who were physically more active had a lower odd for CVDs. The risk of CVDs was increased with increasing body weight and BMI, so that those with BMI≥35 had an odds of 6.8 times higher than those with BMI <18.9 (CI = 2.0–22.5).

The energy intake and percentage of energy intake from carbohydrates both with OR = 0.99 prevented the CVDs, whereas percentage of energy intake from protein (OR = 1.02, CI = 0.98–1.05) and fat (OR = 1, CI = 0.99–1.02) were risk factors for the CVDs.

People with HTN had significantly higher odds ratio of CVDs (OR = 40.5, CI = 32.6–50.3) than those without HTN; this association was increased after adjustment for the confounding variables (OR = 28.6, CI = 22.7–36). People with dyslipidemia had a 1.9 fold higher risk of CVDs; the odds ratio remained significant after adjusting the confounding variables (OR = 1.6, CI = 1.3–2.0). In the univariate analysis, the risk of CVDs was 3.8 times higher in individuals with diabetes than in those without diabetes (CI = 3.0–4.8), but no significant association was found after adjusting the confounding variables (Table 2).

Overall, a direct association was observed between DII and CVDs, with odds ratio of CVDs in the fourth quartile being 1.4 times higher than in the first quartile of DII (CI = 1.1–1.8), but this association was not significant after adjusting the confounding variables (Table 2).

Figure 1 shows the dose-response relationship between DII and odds ratio of CVDs. After controlling the effects of demographic variables and BMI, with increasing DII, the odds ratio of CVDs was increased in both sex groups. In addition to the greater magnitude of this increase in women than in men, the effect of DII on women with heart disease was also greater.

Discussion

The DII has a direct association with the CVDs. Older age was identified as an important risk factor for CVDs, and DII score was increased with age. The odds ratio of CVDs in the fourth quartile of DII was 1.4 times higher than in the first quartile. Our findings were similar to studies in Espain, United States and France witch showed that pro inflammatory diet can increase the risk of CVDs and metabolic syndrome [1, 2, 10, 14].

The results of our study showed that the prevalence of HTN and dyslipidemia was higher in the upper quartiles of DII than in the lower quartiles. In a cross-sectional study in Luxembourg, the prevalence of dyslipidemia in high quartiles of DII was also higher than in low quartiles [20]. In a study in France, there was also a significant association between increased DII score and the risk of metabolic syndrome, HTN, and increased triglyceride, but no significant association was reported with FBS and waist circumference [14]. In the present study, the obesity had a direct and significant association with CVDs and DII, so that people with the most powerful pro-inflammatory diet were obese and at higher risk of CVDs. Ruiz-Canela et al.(2015) also observed an association between higher DII score and obesity, especially abdominal obesity [6]. As BMI and prevalence of overweight and obesity have increased with increasing DII quartiles, it can be expected that the prevalence of dyslipidemia and HTN is also higher in the fourth quartile than in the first quartile. Given that the level of physical activity decreased with increasing DII quartiles, one might expect a higher prevalence of obesity and dyslipidemia in the fourth quartile than in the first quartile.

In the present study, the mean energy intake in the fourth quartile was significantly lower than the first quartile of DII. Bawaked et al.(2017) support the results of ours. Both in the adult population and in children, a characteristic low-energy diet is usually a diet rich in healthy foods, including fruits and vegetables. In the present study, similar to the study of Bawaked et al.(2017), the inflammatory potential of the diet was increased with increasing energy density, but the energy intake was decreased. It should be noted that a high energy density diet does not necessarily have high energy intake compared to a low energy density diet because there are a large number of nutrients with different total energy content per unit of energy density [21].

In this study, the risk of CVDs in women was 1.6 times higher than in men, which may be due to the higher prevalence of CVDs risk factors, including obesity (70%), HTN (61%) and dyslipidemia (62%) in women. One reason for the higher reported CVDs in women than in men may be that they are more likely to visit a doctor and take medication because women are more likely to seek medical attention than men and are more likely to visit a physician. In fact, in RaNCD cohort study the definition of CVDs is partly based on self-reported data in addition to CVDs-drug specific consumption. It is worth noting that inappropriate dietary patterns in women can also be important causes of their higher prevalence of CVDs than in men.

In the present study, the level of inflammatory markers has not been measured but since obesity is actually a type of inflammatory condition in the body and as the prevalence of obesity has increased with increasing quartiles of DII, it can be concluded that the results of this study show association of DII with inflammatory conditions. Similar to the results of the present study, Fung et al.(2005) observed the association of dietary indicators, including the Alternate Healthy Eating Index (AHEI) and the alternative Mediterranean Diet Score (aMED) with inflammatory markers including CRP [22]. In this study, no significant association was found between diabetes and DII score. The results of studies in Luxembourg (cross-sectional) and Spain (prospective) support the results of the present study [20, 23]. In these studies, no significant association was also found between DII and metabolic syndrome components [23]. However, the results of some studies contradict the results of this research. For example, in a study of Wirth et al.(2014) in the USA, there was a significant association between abnormal blood glucose levels with increased DII [10]. One of the reasons could be the in vitro differences in measuring the blood glucose levels in people with diabetes, as well as differences in studies defining diabetes or differences in the criteria that determine diabetes, which have led to different results.

One of the limitations of the present study was the impossibility of investigating the association between DII and serum levels of inflammatory markers, as serum levels of these markers were not measured in the early phase of the RaNCD cohort study. One of the advantages of the present study is that this is the only study aimed to determine the association of DII with CVDs among the Kurdish population in Iran with a large sample size. Other strengths of this study could be the high quality of data collection, population-based study, and adjustment of all known confounding factors including age, gender, physical activity, Wealth, BMI, energy intake, and percentage of energy derived from macronutrients. On the other hand, the use of DII rather than inflammatory markers to assess the impact of inflammation on clinical outcomes can help directly measurement of the diet impact on clinical outcomes through inflammation, and secondly reduction of the study costs. The calculation of DII through a cost-effective and non-invasive method (FFQ) can evaluate the inflammatory properties of the diet.

Conclusion

Given the role of diet through inflammatory properties on the incidence of diseases such as CVDs, it is recommended to consider the dietary inflammatory index in order to prevent, control and treat the disease, with more emphasis on dietary recommendations regarding the consumption of anti-inflammatory diets and reduced intake of pro-inflammatory diets to decrease the risk of disease.

Declarations

Competing interests

The authors declare no conflict of interest.

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Behrooz hamzeh: research idea

Farid Najafi: statistic analysis

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Mehnoosh Samadi: consultation

Sheno Karimi: data cleaning

Fakhereh Faraji: revise of manuscript

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Tables

Table1- Demographic characteristics of participants based on Dietary Inflammatory Index in RaNCD cohort study

P value	Q4**	Q3	Q2	Q1*	Total	Variable	
	1583(24.85)	1569(24.63)	1663(26.11)	1554(24.40)	6369(100)	n (%)	
	N(%)						
	1.4(+0.25,+4.6)	-0.44(-1.0,+0.25)	-1.5(-2.0,-1.0)	-2.8(-4.5,-2.0)	-0.84(-4.5,+4.6)	Mean (min,max)	
<0.001	456(14.15)	729(22.61)	1005(31.18)	1033(32.06)	3223(50.60)	Male	Gender
	1127(35.83)	840(26.70)	658(20.91)	521(16.56)	3146(49.40)	Female	
<0.001	590(20.05)	724(24.60)	854(29.02)	775(26.33)	2943(46.21)	35-45	Age (year)
	514(25.54)	503(24.99)	500(24.84)	496(24.63)	2013(31.61)	46-55	
	479(33.90)	342(24.21)	309(21.87)	283(20.02)	1413(22.19)	56-65	
<0.001	1309(22.97)	1399(24.56)	1526(26.80)	1462(25.67)	5696(89.43)	Married	Marital Status
	131(40.06)	85(26.00)	69(21.10)	42(12.84)	327(5.13)	Single	
	143(41.25)	85(24.46)	69(19.84)	50(14.45)	346(5.44)	Divorced	
<0.001	640(40.60)	375(23.80)	309(19.60)	252(16.00)	1576(24.74)	Illiterate	Education years
	634(26.80)	629(26.58)	598(25.28)	505(21.34)	2366(37.15)	1-5	
	170(15.55)	269(24.58)	326(29.79)	329(30.08)	1094(17.18)	6-9	
	94(11.19)	200(23.81)	262(31.20)	284(33.80)	840(13.19)	10-12	
	45(9.12)	96(19.48)	168(34.08)	184(37.32)	493(7.74)	≥13	
<0.001	510(37.90)	348(25.85)	279(20.72)	209(15.53)	1346(21.13)	Poor	Wealth
	401(30.86)	337(25.94)	300(23.10)	261(20.10)	1299(20.40)	2	
	314(24.40)	349(27.11)	352(27.35)	272(21.14)	1287(20.21)	3	
	220(17.75)	285(23.00)	373(30.10)	361(29.13)	1239(19.45)	4	
	138(11.51)	250(20.87)	359(29.97)	451(37.65)	1198(18.81)	Rich	
<0.001	544(15.09)	802(22.23)	1064(29.50)	1197(33.18)	3607(56.63)	City	Place
	1039(37.63)	767(27.77)	599(21.68)	357(12.92)	2762(43.37)	Village	
<0.001	388(23.35)	389(23.40)	458(27.55)	427(25.70)	1662(26.10)	1	Physical Activity (MET/HOUR)
	907(27.86)	829(25.46)	794(24.40)	725(22.28)	3255(51.11)	2	
	288(19.84)	351(24.18)	411(28.30)	402(27.68)	1452(22.80)	3	
<0.001	1325(26.30)	1261(25.04)	1275(25.31)	1176(23.35)	5037(79.09)	No	Smoking
	148(18.33)	197(24.43)	240(29.74)	222(27.50)	807(12.67)	Current	
	110(20.95)	111(21.15)	148(28.20)	156(29.70)	525(8.24)	Former	
<0.001	47(36.71)	39(30.47)	26(20.32)	16(12.5)	128(2.01)	<18.9	BMI(kg/m^2)
	553(28.52)	480(24.75)	478(24.65)	428(22.08)	1939(30.44)	19-24.9	
	633(23.15)	654(23.93)	770(28.16)	677(24.76)	2734(42.93)	25-29.9	
	287(22.83)	306(24.35)	309(24.58)	355(28.24)	1257(19.74)	30-34.9	
	63(20.25)	90(28.94)	80(25.73)	78(25.08)	311(4.88)	≥35	
0.007	1326(24.19)	1343(24.50)	1451(26.47)	1361(24.84)	5481(86.06)	No	Hypertension
	257(28.95)	226(24.46)	212(23.87)	193(22.72)	888(13.94)	Yes	
0.000	970(26.90)	907(25.15)	910(25.24)	819(22.71)	3606(56.62)	No	Dyslipidemia
	613(22.20)	662(23.95)	753(27.25)	735(26.60)	2763(43.38)	Yes	
0.795	1472(24.98)	1445(24.52)	1542(26.15)	1436(24.35)	5895(92.56)	No	Diabetes
	111(23.41)	124(26.17)	121(25.52)	118(24.90)	474(7.44)	Yes	
<0.001	1394(24.08)	1433(24.75)	1539(26.58)	1424(24.59)	5790(90.9)	NO	CVDs
	189(32.64)	136(23.49)	124(21.42)	130(22.45)	579(9.1)	YES	
<0.001	1974.7(529.8)	2791.8(673.2)	3357.6(808.7)	3914.35(950.1)	3010.3(1039.9)	Mean (SD)	Calorie intake(Kcal/day)
<0.001	59.56(6.99)	58.75(5.90)	58.60(5.65)	57.69(5.53)	58.65(6.08)	Mean(SD)	Charbohydrate Kcal(%)
<0.001	12.7 (2.5)	13.3 (2.3)	13.5 (2.1)	(2.2)13.7	13.3 (2.3)	Mean(SD)	Protein Kcal(%)
<0.001	27.7(6.4)	27.9 (5.4)	27.8 (5.0)	28.5(4.8)	28.0 (5.49)	Mean(SD)	Fat Kcal(%)

*(anti inflammatory)
** (pro inflammatory)

Table 2- Odds ratios for cardiovascular diseases

Adjusted (OR(95% CI	Crud (OR(95% CI	Total (%)N	Variable	
1	1	(%7.0)227/3223	Male	Gender
(1.2-1.9)1.5	(1.3-1.9)1.6	(%13.9)352/3146	Female	
1	1	(%3.0)90/2943	35-45	Age
(0.9-1.5)1.2	(2.4-4.1)3.2	(%11.0)186/2013	46-55	
(1.3-2.1)1.6	(6.7-11.0)8.6	(%24.0)303/1413	56-65	
1	1	(%11.0)516/5696	Married	Marital status
(0.1-0.8)0.3	(0.01-0.24)0.06	(%1.4)2/327	Single	
(0.7-1.4)1.0	(1.6-2.8)2.1	(%19.0)61/346	Divorced	
1	1	(%19.0)260/1576	Illiterate	Education years
(0.87-1.35)1.09	(0.3-0.5)0.4	(%10.3)196/2366	1-5	
(0.87-1.66)1.20	(0.21-0.38)0.28	(%7.2)59/1094	6-9	
(0.84-1.89)1.26	(0.18-0.36)0.25	(%5.9)41/840	10-12	
(0.59-1.65)0.99	(0.15-0.38)0.24	(%5.6)23/493	13≤	
1	1	(%12.8)150/1346	Poor	Wealth
(0.87-1.44)1.12	(0.7-1.2)0.9	(%12.8)138/1299	2	
(0.82-1.38)1.06	(0.4-0.8)0.6	(%10.5)97/1287	3	
(0.96-1.64)1.25	(0.6-1.0)0.7	(%10.8)111/1239	4	
(0.99-1.81)1.34	(0.4-0.7)0.5	(%8.5)83/1198	Rich	
1	1	(%10.3)316/3607	City	Place
(0.99-1.40)1.18	(0.9-1.3)1.09	(%12.1)263/2762	Village	
1	1	(%13.8)195/1662	1	Physical Activity
(0.5-0.9)0.7	(0.6-0.9)0.7	(%11.3)298/3255	2	
(0.4-0.8)0.6	(0.3-0.6)0.4	(%7.0)86/1452	3	
1	1	(%11.0)450/5037	No	Smoking
(0.65-1.2)0.88	(0.4-0.8)0.6	(%7.7)49/807	Current	
(0.86-1.49)1.13	(1.4-2.3)1.8	(%16.1)80/525	Former	
1	1	(%4.1)3/128	18.9>	BMI
(0.55-3.28)1.3	(0.8-8.9)2.7	(%7.5)122/1939	19-24.9	
(0.58-3.42)1.4	(1.3-13.2)4.1	(%10.9)250/2734	25-29.9	
(0.57-3.45)1.4	(1.9-19.3)6.0	(%14.9)160/1257	30-34.9	
(0.54-3.50)1.38	(2.0-22.5)6.8	(%16.0)44/311	35≤	
1	1	(%3.4)133/5481	No	Hypertension
(22.7-36.0)28.6	(32.6-50.3)40.5	(%52.5)446/888	Yes	
1	1	(%8.0)243/3606	No	Dyslipidemia
(1.3-2.0)1.6	(1.6-2.2)1.9	(%84.0)336/2763	Yes	
1	1	(%7.0)462/5895	No	Diabetes
(1.3-2.4)1.8	(3.0-4.8)3.8	(%28.9)117/474	Yes	
1	1	(%9.3)130/1554	Q1	DII
(0.5-1.0)0.7	(0.6-1.1)0.8	(%9.2)124/1663	Q2	
(0.4-0.9)0.6	(0.8-1.3)1.0	(%11.0)136/1569	Q3	
(0.5-1.2)0.8	(1.1-1.8)1.4	(%15.2) 189/1583	Q4	
(0.9998-1.00)0.9999	(0.9995-0.9997)0.99	-	Increase one unit	Calorie
(0.98-1.01)0.99	(0.97-1.00)0.99	-	Increase one gram	CHO Kcal
(0.95-1.02)0.99	(0.98-1.05).0)1.02	-	Increase one gram	Pro Kcal
(0.99-1.02)1.00	(0.98-1.02)1.00	-	Increase one gram	Fat Kcal

Figures

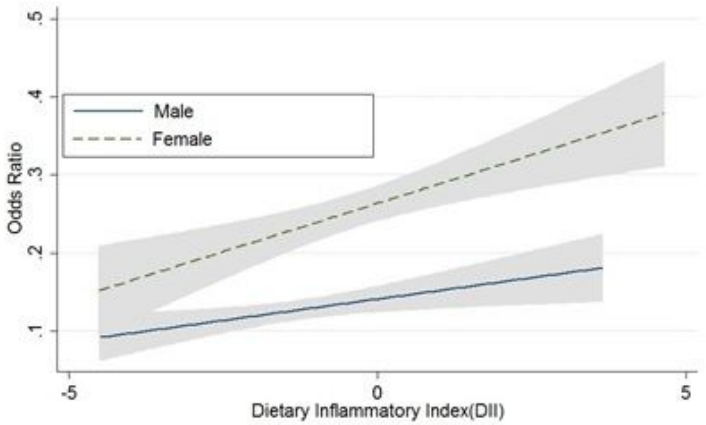

Figure 1

The Association of Cardiovascular Disease with Dietary Inflammatory Index