

Dietary Pattern among Coronary Heart Disease Outpatients Attending Ahmed Gasim Hospital at Bahri Locality, Khartoum North

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Abstract: Coronary artery disease is the most common type of heart disease and the leading cause of death worldwide. Diets high in saturated fatty acids and cholesterol increase the risk of CHD by raising LDL cholesterol levels. In contrast, individuals consuming diets high in fruits, vegetables, whole grains, and unsaturated fatty acids appear to have low risk of CHD due to the presence of antioxidants, folic acid, B-vitamins, omega-3 fatty acids, and others. The objective of this study, to assess of the dietary pattern among Sudanese coronary heart disease outpatients who attending Ahmed Gasim Hospital at Bahri locality, Khartoum North during the period from July 2013 to April 2014. The study was case finding hospital based, Sample size was 72 respondents attended the hospital during the period of July 2013 to September 2014 and they selected by convenience sampling. Results revealed that 50% of the respondents at the age group of ≥ 50 years with high body mass index of 30.6% and 38.9% for overweight and obese respectively. High cholesterol and triglycerides level were recorded among the respondents (22.2%), (11%) respectively, 26.4% with low density lipoprotein cholesterol while 59.7% with low level of high density lipoprotein cholesterol. However, 76.4% of the patients consumed high dietary fats, 12.5% consumed saturated fats, consumption of 61.1% of sodium was demonstrated among the respondents and 33.3% of them consumed less than 2000Kcal per day. Low dietary fibers intake, high dietary protein and low carbohydrate consumption among the respondents were found to be 52.8%, 63.9%, 65.3% respectively. Respondents' age was positively correlated with HDL-C ($R=-0.284^{**}$, $P=0.015$), and LDL-C level ($R=0.377^{**}$, $P=0.004$). Results exhibited that the body mass index was positively correlated with high density lipoprotein cholesterol ($R=0.280^{**}$, $P=0.003$) and the dietary fat was correlated with cholesterol and high density lipoprotein cholesterol ($R=0.312^{*}$, $P=0.022$), ($R=0.351^{*}$, $P=0.011$) respectively. Significant correlation was also found between consumption of foods contain niacin with HDL-C ($R=0.421^{*}$, $P=0.02$); and foods contain vitamin c with LDL-C ($R=-0.322$, $P=0.035$). The study concluded that, there were relationships between some dietary components and coronary heart disease. Effective awareness should be raised among Sudanese population for healthy dietary intake to reduce the risk of coronary heart disease.

Keywords: dietary components, coronary heart disease, LDL, HDL Cholesterol

Background:

Coronary heart disease (CHD) is one of chronic disease often begin by atherosclerosis that occurs due to the deposition of fatty fibrous substance mainly cholesterol in the inside lining of the arteries wall, where it causes plaque accumulation resulting in the narrowing of arteries and increases the risk of Myocardial Infarction (MI) and ischemic stroke (McGill *et al.*, 2010). Dietary pattern has emerged as an alternative and complementary approach to study the relationship between diet and the risk of CHD. Instead of looking at individual nutrients or food, pattern analysis examines the effects of overall diet (Millenet *et al.*, 2011). This disease is mostly caused by improper eating or eating too much fat or sugar. Some foods increase the risk of CHD while others may play as protective

agent against it (Moreira, 2009). Generally, foods containing saturated fatty acids (SFA's) should be restricted to reduce the risk of CHD (Pattyet *al.*, 2010).

Certain amount of high quality protein supply, sufficient vitamins, minerals, and enough complex carbohydrates may protect against CHD (Krauss *et al.*, 2000.) Previous study recommended that, more consumption of fruits and vegetables with less consumption of meats, especially red meat or non-lean meats may protect against CHD (Krausset *al.*, 2000) Globally, An estimated 17.7 million people died from CVDs in 2015, representing 31% of all global deaths. Of these deaths, an estimated 7.4 million were due to coronary heart disease and 6.7 million were due to stroke (WHO,2015). Out of the 17 million premature deaths (under the age of 70) due to non communicable diseases in 2015, 82% are in low- and middle-income countries, and 37% are caused by coronary heart disease. In African regions, the proportions of death from CHD accounted 9.2% of the total deaths in 2012(Wael *et al.*,2012). In developing countries, the problem of CHD and its related diseases is caused by diet shifts, such as changing from simple and traditional diet to a diet that depends on processed foods, foods from animal sources, fats and sugars. This shift is due to internationalization and commercialization of food trade (Khalil, 2012).

Sudan like the other developing countries had high prevalence of CHD but epidemiological data concerning dietary intake and CHD are scarce (Khalil and Al Zain, 2012). According to the recent statistic in 2011, CHD deaths in Sudan reached 39.326 or 10.67% of total deaths. (Khalil& Al Zain2012). Worldwide Sudan ranks number 24 among the countries with high prevalence of CHD. The statistics surveillance found that CHD was the top of 20 cause of death among Sudanese populations. In Sudan, the dietary consumption was one of the main risk factor stated by (Khalil & Al Zain, 2012).

Justification:

Coronary Heart Disease (CHD) is the leading cause of death among adults in developing countries. It is also called Coronary Artery Disease (CAD)(Khalil, Al Zain, 2012). Diet plays an important determinant role of chronic diseases risk including heart disease. Much of the focus from last century was concentrating on the contribution of diet especially dietary fat to heart disease (Haskell,2003).Nowadays, coronary heart diseases is widely spread in Sudan accompanied with remarkable change of dietary pattern, this drew the researcher attention to assess the dietary pattern among CHD Sudanese outpatients.

Objective:

To assess the dietary pattern among Sudanese coronary heart disease outpatients who attended Ahmed Gasim Teaching Hospital in Bahri locality at Khartoum North.

Research Methodology:

Cross-sectional case finding type was used in the present study. The study area was Ahmed Gasim Hospital at Khartoum Bahri locality. Study population included outpatient diagnosed with CHD in both males and females. The sample size was 72 respondents attended the hospital during the period of July 2014 to September 2015 were selected by convenience sampling. Weight and height were measured to calculate the body mass index,24 recall hours was done to identify the dietary pattern among the patients with coronary heart disease

Results:

Table 1. Respondents' Demographic Characteristics.

Gender	Frequency	Percent %
Male	43	59.7
Female	29	40.3
Total	72	100
Age	Frequency	Percent %
30-40 Years	4	5.6
41-50 Years	9	12.5
> 50 Years	59	81.9

Table 2. Respondents' BMI.

BMI /kg/m ²	Frequency	Percent %
<18.5	6	8.3
18.5-24.9	16	22.2
25-29.9	22	30.6
30-34.9	20	27.8
35-39.9	5	6.9
≥40	3	4.2
Total	72	100

Table 3. Respondents' blood lipid profile classification.

Cholesterol/mg/dl	Frequency	Percent %
Normal < 200	9	12.5
Border line 200-239	47	65.3
High ≥ 240	16	22.2
Total	72	100
TGs/mg/dl	Frequency	Percent
Normal < 150	5	7.0
Border line 150-200	59	82.0
High > 200	8	11.0
Total	72	100
LDL-C/mg/dl	Frequency	Percent %
Normal <130	3	4.2
Border line 130-159	50	69.4
High ≥160	19	26.4
Total	72	100
HDL-C/mg/dl	Frequency	Percent %
High risk < 60	43	59.7
Moderate risk 90-70	27	37.5
No risk > 90	2	2.8
Total	72	100

Table 4. Correlation between respondents' age and lipid profile.

Variables	Cholesterol		TGs		LDL-C		HDL-C	
	R	P	R	P	R	P	R	P
Age	-	-	-	-	0.377**	0.004	0.284*	0.015

Table 5. Correlation between BMI and blood lipid profile.

Variables	Cholesterol		TG		LDL-C		HDL-C	
	R	P	R	P	R	P	R	P
Body Mass Index	-	-	-	-	-	-	0.280**	0.003

Results in Table 1 shows the distribution of the respondents by age and sex. More than half (59.7%) of them were male and 81.9% of the respondents were at the age 50 or more. According to the classification of the body mass index among the respondents, almost one third (30.6%) of them were overweight, 27.8% were obese class I, 22.2% enjoyed normal-healthy weight, 8.3% were undernourished, 6.9% were at grade II obese and only 4.2% of the respondents had morbid obesity (Table 2). However, this findings showed that the respondents' cholesterol, TGs and LDL-C were at the border line to the cut-off points (65.3%, 82.0%, and 69.4%) respectively, while 59.7% had low level of HDL-C (Table 3).Significant correlation was detected between age with LDL-C (R=0.377**), (P=0.004) and HDL.C (R=0.284*, P=0.015). BMI was also correlated with HDL-C, (R=0.280**, P=0.003).

Table 6. Respondents' Macronutrients.

Energy/ Kcal	Frequency	Percent %
< 2000	24	33.3
2000 - < 2500	14	19.4
2500 - < 3000	12	16.7
≥ 3000	22	30.6
Total	72	100.0
Carbohydrate/ g	Frequency	Percent %
< 250	47	65.3
250 - < 300	13	18.1
300 - < 350	7	9.6
≥ 350	5	7.0
Total	72	100.0
Fibers/ g	Frequency	Percent %
< 20	38	52.8
20 - < 30	21	29.2
30 - < 40	9	12.5
≥ 40	4	5.5
Total	72	100
Proteins/ g	Frequency	Percent %
< 75	19	26.4
75 - < 80	3	4.1
80 - < 85	4	5.6
≥ 85	46	63.9
Total	72	100

Con. Table 6. Respondents' Macronutrients.

Fats/ g	Frequency	Percent %
< 65	12	16.7
65- < 70	3	4.1
70 - <75	2	2.8
≥ 75	55	76.4
Total	72	100
Cholesterol/ mg	Frequency	Percent %
< 200	23	31.9
200 - < 250	6	8.3
250 - < 300	4	5.6
≥ 300	39	54.2
Total	72	100
Saturated Fats/ g	Frequency	Percent %
< 15.5	4	5.5
15.5 - < 20	21	29.2
20 - < 25	38	52.8
≥ 25	9	12.5
Total	72	100

Table 7. Correlation between dietary fat consumption and blood lipid profile levels

Variables	Cholesterol		TGs		LDL-C		HDL-C	
	R	P	R	P	R	P	R	P
Total fats	0.312*	0.022	—	—	—	—	0.351*	0.011

Table 8. Respondents' micronutrients consumption.

Niacin/ mg	Frequency	Percent %
< 20	11	15
20 - < 25	33	46
25 - < 30	24	33
≥ 30	4	6
Total	72	100
Vitamin C/ mg	Frequency	Percent %
< 60	28	39
60- < 65	3	4
65 - < 70	0	0
≥ 70	41	57
Total	72	100
Vitamin E/ mg	Frequency	Percent %
< 20	47	65
20- < 25	2	3
25 - < 30	2	3
≥ 30	21	29.
Total	72	100

Con. Table 8. Respondents' micronutrients consumption.

Sodium/ mg	Frequency	Percent %
< 2400	4	5.6
2400- < 2900	10	13.8
2900 - <3400	14	19.5
≥ 3400	44	61.1
Total	72	100
Potassium/ mg	Frequency	Percent%
< 3500	63	87.5
3500- < 4000	4	5.6
4500 - < 5000	0	0
≥ 5000	5	6.9
Total	72	100.0
Calcium/ mg	Frequency	Percent
< 1000	53	73.6
1000- < 1500	8	11.1
1500 - < 2000	3	4.2
≥ 2000	8	11.1
Total	72	100
Magnesium/ mg	Frequency	Percent%
< 400	59	81.9
400- < 450	4	5.6
450 - < 500	2	2.8
≥ 5000	7	9.7
Total	72	100
Zinc/ mg	Frequency	Percent%
< 15	38	52.8
15 - < 20	8	11.1
20 - < 25	9	12.5
≥ 25	17	23.6
Total	72	100
Iron/mg	Frequency	Percent%
< 18	33	45.9
18 - < 23	14	19.4
23- < 28	7	9.7
≥ 28	18	25
Total	72	100

Table 9. Correlation between niacin, vitamin C intake and blood lipid profile

Variables	Cholesterol		TGs		LDL-C		HDL-C	
	R	P	R	P	R	P	R	P
Niacin* Lipid Profile	-	-	-	-	-	-	0.421*	P=0.02
Vitamin c* Lipid Profile					0.322*	0.035		

Results in Table 6 reveals that 33.3% of the respondents consumed foods containing less than 2000 kilocalories per day while the rest consumed an equal or more than 2000 kilocalories. With respect to the dietary carbohydrates and fibers intake, results reveal that 65.3% of the respondents consumed foods containing less than 250 gram of dietary carbohydrates and 52.8% of them consumed less than 20 grams of dietary fibers per day. The daily consumption of dietary protein among 63.9% of the respondents was equal to or more than 85gram and 76.4% of them consumed foods with equal or more than 75gram of dietary fat. Among 54.2% of the respondents the dietary cholesterol consumption was equal or more than 300 milligram and saturated fat while food with saturated fat

was consumed by 52.8% of the respondents (20 to < 25g). Except of dietary fat, no significant relationship was detected between the intake of food macronutrients and lipid profile of the respondents. Dietary fat intake was positively correlated with cholesterol level ($R=0.312$, $P=0.022$) and with HDL-C, ($R=0.351$, $P=0.011$) (Table 7).

However, results demonstrated that 46% of the respondents consumed foods contain niacin, 57.0% consumed foods rich in vitamin C, 65.% consumed less dietary vitamin E, 61.1% consumed food of equal or more than 3400 milligram of sodium or more and 87.5% consumed less than 3500 milligram of potassium. Consumption of dietary calcium was less than 1000 milligram among 73.6% of the respondents, 81.9% consumed less than 400 milligram dietary magnesium, 52.8% consumed foods with less than 15 milligram of zinc and 45.9% of the respondents consumed foods containing less than 18 milligram of iron (Table 8). Significant correlation was found between vitamin C and LDL cholesterol($R=0.322^*$, $P=0.035$) and niacin with HDL ($R=0.421^*$, $P=0.02$). (Table 9).

Discussion:

Socio demographic data and lipid profile

In the present study 59.7% of the respondents were males and 40.3% were females. It is clear that the disease was more abundant among males than females. Previous study revealed that at younger age, the relative risk of hypercholesterolemia is lower in women than men (Francisco,2013). Regarding the age and coronary heart diseases, results showed that 81.9% of the respondents' age was more than 50 years old and the age was found to be positively correlated with HDL-C level LDL-C level. This indicates that, the risks of CHD increase gradually with the increase in age in both males and females. Some CHD risk factor such as the increase in LDL-Cis higher in older people than in younger people and the principal reason for the rise in the risk with age, is that age is a reflection of the progressive accumulation of coronary atherosclerosis which reflects the exposure to the atherogenic risk factors both known and unknown (Liu,2012).During menopause, total cholesterol and low-density lipoprotein (LDL) levels rise by 10 and 14% respectively and lipoprotein (a) increases from 4 to 8%, whereas high-density lipoprotein (HDL) cholesterol levels remain unchanged (Millen, *et al.*, 2011).

Body mass index and coronary heart disease

Regarding the BMI of the respondents, one third of them were overweight, while the 38.9% were classified as obese. With the respect to the relationship between anthropometric measurement and coronary heart disease, the present study revealed that HDL-C correlated positively with BMI. These findings were in conformity with results of studies which found that BMI was strongly correlated with HDL-C (Fujihara.2017,). Despite the fact that many epidemiological studies showed that general obesity is associated with low risk of HDL-C. The increase of HDL-C among the groups in the present study may be due to factors other than obesity, however some anthropometric indices such as waist circumference if used may give different an accurate results. The results also showed that although respondents were under medications, the majority of them were at the border line for high blood cholesterol, TGs and LDL-C, and with low level of HDL-C. These findings can be attributed to many factors such as the increase of body mass index and their intake of high caloric foods. High lipid lead to the development of coronary heart disease such as myocardial infraction and stroke(Robert,2013).

Respondents' intake of macronutrients

Considering dietary pattern of macronutrients, 33.3% of the respondents consumed less than 2000 Kcal/day Coronary heart disease patients should take food rich in energy beside physical exercise to prevent the weight gain and maintain healthy body weight. A previous study demonstrated that the high consumption of food rich in energy was related to the increase of coronary heart

disease(Frank *et al* ,2012).As for carbohydrates intake, 65.3% of the respondents consumed foods with less than 250 gram of dietary carbohydrates. Dietary carbohydrates are the main source of energy in diet. Consumption of high dietary carbohydrates especially those with high glycemic index appear to influence the risk of developing CHD through the increase of TGs level and reducing the level of HDL-C in the blood (Robinson, 2010). Low carbohydrates diets with low dietary fat had beneficial effect on heart. They regulate dyslipidemia which consider is an important risk factor of heart disease (Patty *et al.*,2010);Low consumption of foods contain dietary fiber were also observed among half of the respondents. This finding may attributed to their low intake of fruits and vegetables. (James *et al*,2010).

The study revealed that (63.9%) (Table 6) of the respondents consumed high protein diet $\geq 85g$ High protein diet with low carbohydrates had been found to have positive effect on the reduction of serum TGs and improve HDL-C in the blood (Layman *et al.*, 2008).Replacing animal proteins with plant proteins may protect humans from CHD. Evidence from an epidemiological study showed that there was a strong correlation between consumption of animals' proteins and CHD (Renata, *et al* ,2010).

The present study revealed high dietary fat intake among respondents (75gram). Intake of food with low amount of dietary fat is requiring for CHD patient to avoid lipoproteins abnormalities. More than half of the participants consumed foods containing high dietary cholesterol. Excessive intake of dietary cholesterol associated with the risk of atherosclerosis and CHD (Lands& William, 2005).

It was observed that more than 52.8% and 12.5% of the respondents consumed foods containing high saturated fats. Excessive amounts of saturated fat increase the blood cholesterol which is the risk factor of CHD (Schwingshackl & Hoffmann, 2012).

Respondents' intake of micronutrients

The result demonstrated that 46% of the respondents take moderate amount of niacin (20 - < 25). Niacin is an important vitamin that reduced LDL-C and TGs levels in the blood; Significant correlation was found between the consumption of foods rich in Niacin and HDL-C. (Lukasova*et al.*, 2011).Evidence from a previous study demonstrated that people with high cholesterol levels who consumed foods rich in niacin had a lower risk of first heart attack and stroke (Lukasova*et al.*, 2011).

Regarding vitamin C consumption, significant correlation was detected between the consumption of foods containing vitamin C and LDL-C. Vitamin C is the one of the important antioxidant, that helps in reducing the amount of lipid in the body. It is the predominant plasma antioxidant. This vitamin scavenges plasma free radicals and prevents their entry into LDL-C particles. Vitamin C regenerates active vitamin E and increases cholesterol elimination from the body.,(Wang *et al*,2014).).Despite that57.0%of patients consumed foods that containing vitamin C but they had coronary heart disease. This may be attributed to the wrong method of preparing food that containing vitamin C which is known to be very sensitive to slicing during preparation, heat and high cooking temperature that contribute to its severe reduction in the food (Pendre *et al*, 2012).

As for vitamin E, 65 % of the respondents consumed less dietary vitamin E. Vitamin E is an antioxidant agent that prevent the oxidation of LDL-C . Epidemiological studies suggested that, people with heart disease who consumed foods rich in vitamin E had relatively fewer atherosclerotic plaques and low rates of death from heart disease (Saremi, Arora,2012).

Concerning sodium dietary intake, results revealed that 61.1% of the respondents consumed food containing high sodium. High dietary sodium intake damage the blood vessels walls over a time, causing scarring and narrowing of blood vessels that promotes hypertension which is the major CHD risk factor, causing the build-up of fatty plaque where eventually block arteries (Afridi *et al.*, 2010).Consumption of potassium was low as showed by 87.5% of the respondents. Potassium is extremely important for proper heart functions and muscles contraction. It is also controls the muscular fuel supply. Potassium deficiency in the diet affects all muscles,

leading to muscles' weakness that including heart muscles (Shils,2011). Low consumption of food containing dietary calcium was predominant among the respondents. Calcium reduces the total cholesterol, LDL-C and prevents blood clots. It is essential for muscle' health. Calcium deficiency correlates with higher level of cholesterol, a major risk factor of heart disease (Umesawa *et al.*, 2006). Consumption of magnesium was very low among the respondents (81.9%) (<400mg) Magnesium decreases heart disease risk and sudden death and has very strong effect in the prevention of blood pressure. A diet should be high in magnesium, potassium, and calcium and low in sodium and fat to reduce the risk of coronary heart disease (Afridi *et al.*,2010).

More than half of the participants consumed foods contain less than 15 milligram of zinc). Zinc is important for heart health; it affects the level of lipid profile in the blood. Low serum zinc increases LDL-C and decreases the level of HDL-C. Evidence from epidemiological study revealed that, low serum concentration of zinc is associated with CHD (Little *et al.*,2010).Regarding Iron consumption, the result demonstrated that 45.9% of the respondents consumed foods contain low iron. Iron has an important role in carrying oxygen in the blood and contributes in the process of lipid per-oxidation. Low amount of iron on the diet cause anemia and affect heart health. Some experimental data supported the role of iron in the process of lipid per-oxidation and formation of atherosclerotic lesions (Emanuela *et al.*, 2013).

Conclusion:

The present study showed, among the coronary heart disease outpatients, the majority were males, their age above 50 years. Significant association between some of dietary pattern and coronary heart diseases Nutrition education and awareness are needed among Sudanese populations regarding the health risk associated with CHD such as the type of diet, obesity and physical inactivity, education and health education should be undertaken to curb the disease.

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