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RESEARCH ARTICLE

Lipid profile of patients monitored in Cardiology department at the Army Instruction Hospital of Parakou in northern Benin (West Africa).

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Abstract

Background: Hypercholesterolemia is a metabolic disorder that often contributes to many diseases such as atherosclerosis. It is responsible each year of the death of over 17 million people, or 30% of mortality in the world.
Methods: This study aims to assess the lipid profile and associated risk factors with dyslipidemia of patients monitored at the Army Instruction Hospital of Parakou. It is a descriptive and analytical study that includes 80 patients admitted to the cardiology department of the Army Instruction Hospital (in consultation or hospitalization) for four months. Lipid profile of our patients was obtained through a recount of their medical folder and biochemical assays using the ELITECH Clinical Systems kits.
Results: Results showed that the mean values of total cholesterol, HDL-cholesterol, triglycerides and LDL-cholesterol were respectively 1.94 ± 0.41 g / L; 0.58 ± 0.12 g / L; 1.20 g / l ± 0.57 and 0.38 ± 1.11 g / L. Thus 42.5% of patients had hypercholesterolemia. This study also showed that risk factors associated with high cholesterol were: diabetes, fruit and vegetable consumption, eating habits, abdominal obesity.
Conclusion: These results suggested the adoption of food safety for the general population to prevent dyslipidemia and certain cardiovascular diseases.

INTRODUCTION

Hypercholesterolemia is defined as an abnormal increase in cholesterol in the blood. It is a metabolic disorder that often contributes to many diseases such as cardiovascular pathologies. In most cases, high cholesterol is also associated with a high diet in fat, especially saturated fat and lack of physical activity. More rarely increased cholesterol may be associated with an inherited disorder known as familial hypercholesterolemia (Assmann *et al.*, 1999). This is one of the major factors risk for atherosclerosis. The incidence of Coronary Artery Disease events is

directly related to plasma levels of LDL-cholesterol (Low Density Lipoprotein) and inversely related to HDL-cholesterol (High Density Lipoprotein) (Assmann *et al*., (1999); Braunwald, (1997)).
Thus, cholesterol metabolism is a key element in the development of cardiovascular disease (Ros, (2000); Law *et al.*, (2003)). Recently, experimental studies associated with pathological observations in human atherosclerotic plaques allowed to deduct that atherosclerosis is a chronic inflammatory disease of the large arteries with intimal location (Law *et al.*, 2003). The most likely cause/trigger of the inflammatory response is the LDL-cholesterol in an oxidized form. It is responsible each year of the death of over 17 million people, up to 30% of death worldwide, according to the World Health Organization. ¾ of these deaths occur in countries with low- and middle-income. More than 25 million deaths are expected in 2020 (Saïle and Taki, 2007). Epidemiological studies conducted over the last sixty years have provided irrefutable evidence that high cholesterol is one of the cardiovascular risk factors and is associated with a higher risk of developing coronary disease. Several studies confirm that there is a direct relationship between cholesterol and cardiovascular mortality (Smith and Pekkanen, 1992). The majority of cardiovascular deaths occur in patients with cholesterol levels between 1.80 and 2.50 g / L (Serfaty- Lacrosnière *et al*., 2011). Therefore, it constitutes a public health problem. Several researchers are struggling to find a drug treatment and / or dietetics. The most effective drugs against atherosclerosis are cholesterol-lowering and belong to the class of statins. However, statins reduce mortality from cardiovascular disease in only a third of patients (Morozovas *et al*., 2002). It is in this context that a previous study (Smart *et al*., 2011) evaluated the effects of hypo lipids dietary in cholesterol. From this study; it appears that low fat diets have a beneficial effect on cholesterol and thus greatly reduce cardiovascular disease. It has also been shown by Moutawakilou, (2013) that there is a difference in several serum lipid parameters between two groups (adult Fulani nomadic subjects and not). Thus, nomadic Fulani subjects had significantly lower values of serum concentrations of total cholesterol, HDL-Cholesterol and LDL-Cholesterol compared to non-Fulani subjects. Therefore, they suggest the adoption of feeding behavior of northern Benin nomadic Fulani by the entire population to prevent dyslipidemia and certain cardiovascular diseases. Effects of dietary advice in order to attain sustainable change in diet or enhance cardiovascular risk profile of healthy adults had also been evaluated by (Rees *et al*., 2007). It appears that dietary advice involves modest beneficial changes in diet and cardiovascular risk factors. The objective of this work aims to study the lipid profile and risk factors associated with dyslipidemia of patients in Army Instruction Hospital of Parakou, to help people prevent atherosclerosis.

Materials

Study population and sampling

This descriptive, analytical and prospective study was carried out over four (04) months. It focused on all patients admitted to the cardiology department of Army Instruction Hospital (in consultation or hospitalization) during the study period (January to April 2013).The sample size was calculated by SCHWARTZ formula: ($n=(z^2 XpXq)/i^2$).
With z = 1.96 for a risk of 5%; p = 1.8% (according to the STEPS survey performed by the National Program against Non Communicable Diseases, 2008); q = 1-p; i = 0.03.
$n= (1.96^2X0. 018X0.982)/0.03^2=75.44$
After increase of 10%, we finally used the size of 80 patients. We performed an exhaustive survey of all patients respecting inclusion criteria and who have not been excluded. All patients (men or women older than 15 years, having cholesterol check dated within three months, and who have given their consent) were included. Patients wearing edema, those living with Human Immuno Virus deficiency (HIV) and those under Anti Retro Viral (ARV) and pregnant women were not included.

Data Collection

The data were complemented by an exhaustive count of medical records. After patients encounter and read the consent form, a questionnaire was administered and the information was collected. This information include socio-demographic characteristics (age, sex, hometown), clinical data (personal history (Hyper Blood Pressure, Diabetes, pinch of snuff, contraception, menopause, obesity), cardiovascular diseases (Cerebral Vascular Accident, Heart infarction, heart failure), family history), dietary habits (number of meals per day, fat, non-fat, salty, type of used oil, fruit and vegetable consumption), and lipid profile. The missing information was supplemented with the patient's medical record.
All participants gave informed consent at the start of the study and the study was performed according to the guidelines of the declaration of Helsinki. The study was approved by the authorities of the cardiology department of the Army Instruction Hospital and by the University Ethics Committee.

Overweight balance sheet
Body mass index

The Body Mass Index (BMI) was calculated based on the weight and height of the patient. BMI is equal to weight in kilograms divided by the patient's height in meters squared (BMI = kg / m^2).

Determining the quantity of fat

The appreciation of the importance of the fat was made following these recommendations (AFSSAPS, 2000). The limit for waist circumference beyond which there is abdominal obesity regardless of BMI is 98 Cm for Women and 102 Cm for men. The measurements were performed in a standing position between the iliac crests and the last rib.

Biochemical parameters

All biochemical parameters were determined using ELITECH Clinical Systems SAS.

Blood glucose assay with glucose oxidase

Blood glucose was performed by colorimetric assay. From the stock glucose solution at 5.5 mmol / L, we prepared diluted solutions at 1/2, 1/4, 1/8, 1/16 and 1/32. Then, we added 30 mL of each solution of glucose. A sample of H_2O was used as control. The tanks were kept in a water bath for 10 min at 37 ° C before measuring the absorbance with spectrophotometer at 500 nm. The standard curve A = f ([glucose]) was plotted. The same procedure was performed with the serum to obtain blood glucose. Concentration was calculated with the formula:
C= (OD sample)/(OD standard) x C standard. The values obtained were compared to the normal values (0.70- 1.10) g / L.

Triglycerides assay

Triglycerides were assayed according to Fossati and Prencipe, (1982) method. The glycerol released after hydrolysis of triglycerides by lipoprotein lipase was converted to glycerol-3-phosphate glycerokinase. Glycerol 3-phosphate was subjected to the action of the glycerol phosphate oxidase to form dehydroxyacetone phosphate and hydrogen peroxide. The latter in presence of peroxidase oxidizes a chromogen group 4- aminoantipyrine / phenol to form a colored compound in red. Absorbance was read at 500 nm and the values are compared to normal values (0.60 to 1.60) g / L.

Cholesterol assay

Cholesterol esters were hydrolyzed by a cholesterol ester hydrolase into fatty acid and cholesterol. This latter and the preexisting were oxidized by cholesterol oxidase to A4-cholestenone and hydrogen peroxide. The latter, in the presence of peroxidase, oxidizes the chromogen 4-amino-antipyrine in a red colored compound of maximum absorbance at 505 nm.

HDL-Cholesterol assay

LDL-cholesterol was precipitated by a hemolysis tube in which 50 µl of reagent A (ELITECH Kit) and 500µL of serum were introduced. The sample was mixed by vortex and let standby for 10 minutes and then centrifuged at 4000 rpm/ min for 15 min. After centrifugation, the cholesterol associated with high density lipoprotein (HDL)-cholesterol was assayed in 50 µl of supernatant which was added to 1000µL of reagent A (ELITECH Kit). The optical density of the mixture was read with spectrophotometer at 500 nm after 5min of incubation at 37 ° C. The obtained values were compared with normal values (≥ 0.4 g / L). LDL-cholesterol was estimated by the following formula: LDL-cholesterol (g / L) = total cholesterol (g / L) –HDL-cholesterol (g / L) - triglycerides (g / L) / 5 if triglycerides are less than 3.4 g /L

Protein assay

Protein assay was performed by the Biuret method as reported by Doumas *et al*., (1981). In alkaline solution, the proteins form with the cupric ions a colored complex with absorbance measured at 540 nm. The determination of different concentrations was performed using a calibration curve of human serum albumin.
The measured values were evaluated by comparison with the criteria of the French Agency for the Safety of Health Products (AFSSAPS, 2000). According to this agent, dyslipidemia is defined by at least one of the criteria presented in Table 1.

Table 1. Value for abnormal lipid profile

Paramètres	abnormal values
Total cholesterol	<2 g/L
Triglycerides	<1.5g/L
HDL-cholesterol	> 0.4-0.5 g/L
LDL-cholesterol	variable according to the number factors risk: 1 à 1.6 g/L

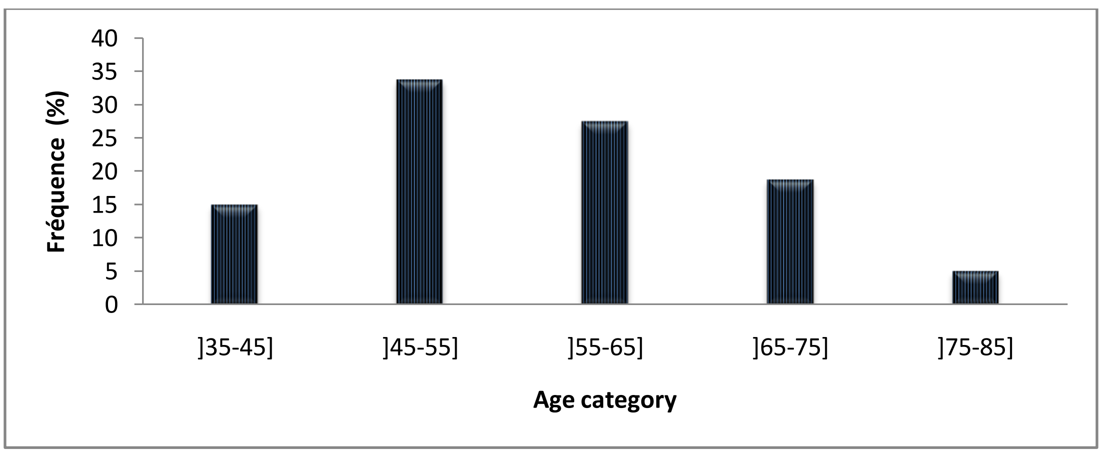
Processing and analysis of data

The data were entered into the Epi-DATA version 3.1software. The association between the dependent and independent variable was performed using Chi-square test with p-value monitoring. The significance level was 5%. To study the direction of the association, the Odd-ratio (OR) was calculated.

Results

Sociodemographic characteristics

Among the 80 subjects included in the study, 34 were men and 46 women sex (sex ratio: Male / Femalewas 0.74). The average age was 57 ± 10 years. The modal class was 45 to 55 years. The subjects were mostly residents of the city of Parakou (90.0%).



H+ = hypercholesterolemia positive; H- = hypercholesterolemia negative

Figure1. Distribution of patients by age groups.

Clinical data (cardiovascular risk factors, personal and family history) of patients.

Table 2. Clinical data of patients

Parameters	Percentage (%)
Cardiovascular risk Factor	
Arterial hypertension	95.0
Diabetes	36.3
Taking Tobacco	10.0
Contraception	3.8
Menopause	25.0
Cardiovascular diseases	
Cardiovascular accident	7.5
Cardiac insufficiency	16.2
Renal Insufficiency	5.0
None	71.2
Family history	
Diabetes	28.8
Arterial hypertension	80.0
Obesity	75.0
Dyslipidemia	1.3
BMI	
18.5< BMI< 25 (Normal)	20.0
[25-30[(overweight)	26.2
≥ 30 (obesity)	53.7

Hypertension was present in 95.0% as showed in Table 2. This table also shows that 16.25% suffered from heart failure. The percentage of patients who had a family history associated with hypertension and obesity were respectively 80% and 75%. Finally, 53.75% were obese.

Description of patient's lipid profile

Table 3 shows the blood cholesterol level of patients

Table 3. Subject's cholesterol level

	HDL-cholesterol		**LDL-cholesterol**		**Total cholesterol**		**Triglycerides**	
	Number	Frequency (%)	Number	Frequency (%)	Number	Frequency (%)	number	Frequency (%)
Normal	74.0	92.5	37.0	46.3	23.0	28.8	54.0	67.5
Abnormal	6.0	7.5	43.0	53.8	57.0	71.3	26.0	32.5
Total	80.0	100.0	80.0	100.0	80.0	100.0	80.0	100.0

Analysis of this data indicates that 53.8% of patients had abnormal LDL-cholesterol (abnormal LDL / normal LDL; ratio =1.16). 7.5% had abnormal levels of HDL cholesterol. 67.5% of patients had normal triglycerides levels. The majority of them (71.3%) had an abnormal total cholesterol level.

Patients Lifestyle and Cholesterolemia

Table 4 below shows the lifestyle of patients in relation with cholesterol

Table 4. Food habits, sports activities and Cholesterolemia

Parameters	Absolute frequency	Percentage (%)	H+	H-
Number of meals per day				
Two	2.0	2.5	0.0	2.0
Three	69.0	86.3	29.0	40.0
Four	9.0	11.3	5.0	4.0
Total	80.0	100.0	34.0	46.0
Type of meal				
Fat	43.0	53.75	28.0	15.0
Non fat	37.0	46.25	6.0	31.0
Total	80	100.00	34.0	46.0
Most used oil				
Karite butter	7.0	8.8	4.0	3.0
Peanut oil	66.0	82.5	27.0	39.0
Palm oil	2.0	2.5	0.0	2.0
Groundnut oil / Karite	1.0	1.2	0.0	1.0
Consumption of fruits and vegetables				
Little	67.0	83.8	32.0	35.0
Enough	13.0	16.55	2.0	11.0
Sports Activities				
Yes	63.0	78.75	26.0	37.0
No	17.0	21.25	8.0	9.0

H+ = hypercholesterolemia positive; H- = hypercholesterolemia negative

Most of the patients (86.3%) had at least three meals a day. 53.75% consumed fatty meal. Also, 82.5% consumed mostly peanut oil, and only 11.2% were including in their diets a lot of fruits and vegetables. Sedentary accounted for 21.2% of the surveyed patients. There was no significant association between the number of meals eaten per day, physical activities, the most used oil and hypercholesterolemia (p =.34; p =.33; p=.32 respectively). However, there was a statistically significant association between the consumption of fruits and vegetables, the type of meal and hypercholesterolemia (p =.03, p =.00001 respectively).

Body mass index and Cholesterolemia

Table 5 shows the distribution of patients according to their Body Mass Index. Analysis of this table reveals that 26.25% of patients were overweight and 53.75% were obese. We also note that the high cholesterol increases with Body Mass Index, but it was no significant association between Body Mass Index and high cholesterol (p =.68).

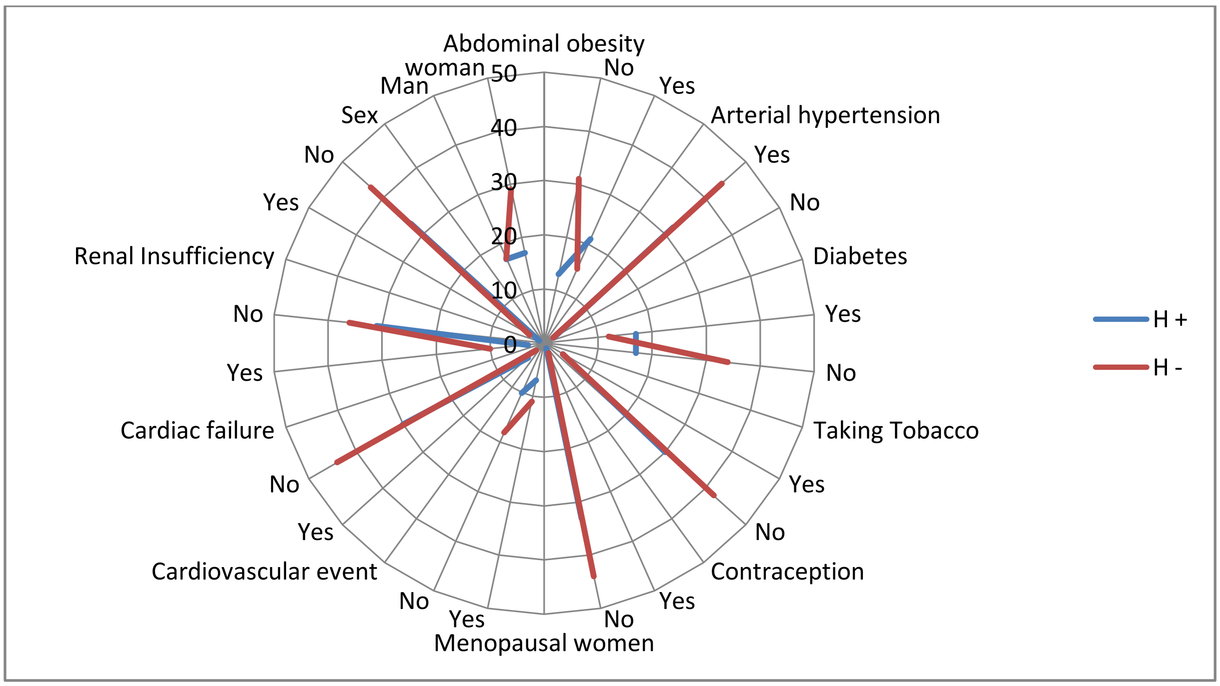
Table 5. Distribution of patients according to the Body Mass Index.

BMI values	Frequency (%)	Interpretation	H+	H-
<18.5	0	Sufficient weight	0	0
18.5<BMI< 25	20.00	Normal Weight	8	8
[25-30[	26.25	Overweight	10	12
≥ 30	53.75	Obesity	16	26
Total	100.0		34	46

H+ = hypercholesterolemia positive; H- = hypercholesterolemia negative

A personal, Family history and Cholesterolemia

There was no significant association between hypertension, tobacco/smoking, contraception, menopause, heart failure, renal insufficiency, stroke and hypercholesterolemia (p = .38,p = .46, p= .61, p= .53, p= .10, p= .44, p= .20, p = .53 respectively). At the same time, there was a statistically significant association between diabetes, abdominal obesity and hypercholesterolemia (p = .02 andp = .0088 respectively).The factor most associated with high cholesterol in multivariate analysis is diabetes (Figure 2).



H+ = hypercholesterolemia positive; H- = hypercholesterolemia negative

Figure 2. Cholesterol and personal and family history

Discussion

In summary, hypercholesterolemia was identified in 42.5% of patients; the mean values of HDL- cholesterol, triglycerides levels and LDL-cholesterol were respectively 0.58 ± 0.12 g / L, 1.20 ± 0.57 g / L and 1.11 ± 0.11 g / L. Most of them (86.3%) had took at least three (3) meals per day and 53.75% of them had consumed fatty meal. Peanut oil was the most oil used (82.5%) and 83.8% did not consumed lot of fruit and vegetables. In this survey, high cholesterol was associated with the fatty meal (p = .00001), low consumption of fruits and vegetables (p = .03)

and diabetes (p = .02). The proportion of subjects with hypercholesterolaemia was practically similar to that obtained by the Canadian Health Measures Survey (40%) among those aged 20 to 79 years (Sen *et al*., 2000). Gender presents close relationship with the risk of high cholesterol (Ducreux et al., (1999); Jaffer *et al*., (2002); Modena et al., (2002)). Comparing differences between the cholesterol proportion of men and women, no statistically significant correlation was observed. This result was contrary to those reported by different authors (Cohen *et al*., (1995); Fazio *et al.,* (1993); Goode *et al*., (1995)) and can be explained by social environmental pressure; the daily consumption does not vary according to gender. However, the increase of the blood testosterone content could increase the risk of atherosclerosis by HDL-cholesterol decrease in men. In women, estradiol has a protective role over its rate increases, the HDL-cholesterol increases. This could explain the results obtained by the authors mentioned above. Also, the size of our sample might explain absence of difference.
High blood pressure is often related to a disturbance of lipid (Fazio *et al.*, 1993). The authors (Goode *et al*., 1995) found a link between high blood pressure, cholesterol, triglycerides and HDL-cholesterol. Their results were not similar to those we obtained in this study. No association between high blood pressure and high cholesterol has observed. This could be explained by the proportion of non-negligible hypertensive subjects (5%) respondents.

Lipid metabolism disorders play a key role in the pathophysiology of atherosclerosis and diabetes. Changes were observed in the quantity but also the quality of lipoproteins. Dyslipidemia is characterized by increased triglycerides by hyper production of the Very Low Density Lipoprotein (VLDL) from liver or increased LDL-cholesterol or HDL-cholesterol lowering conferring an atherogenic lipid profile (Khoury *et al*., 1997). Agmon *et al*., (2002) have studied the influence of diabetes on atherosclerosis of the thoracic aorta and had noticed that in diabetics, the percentage of complex arteriosclerotic plaques was much larger than in non-diabetics ($p <0.01$), as showed by the association of diabetes with high cholesterol in this study (p =.02).

The proportion of subjects with hypercholesterolemia among those who consumed fatty foods (65.11%) was significantly higher than that those who consumed non-fatty foods (16.21%), with p = .00001. This result could be explained by marketing and excessive consumption of poor quality oil (rich in saturated fatty acids) and which is likely to increase the level of cholesterol in the blood.
Several studies have described the association between high cholesterol and smoking. This factor multiplies the risk of developing high cholesterol by 3.36 in Western countries (Fazio *et al.*, 1993; Khoury *et al*., 1997). Sen *et al*., (2000) described a dose / effect relation between smoking and the presence of plaques: more the patient smokes, higher the level of cholesterol increases. The non-association between smoking and high cholesterol observed in this study would be justified by the low rate of nonsmoking patients in the sample.
The proportion of subjects with hypercholesterolemia among those consuming little fruit and vegetables (47.76%) was significantly higher than that of subjects consuming enough fruits and vegetables (8.69%). This result could be explained by the presence of antioxidants in fruits and vegetables that would fight against the oxidation of LDL-cholesterol. Indeed, low fruit and vegetables is one of the behavioral risk factors related to non-communicable diseases such as the case of atherosclerosis, a consequence of high rate of total cholesterol. Abdominal obesity was associated with hypercholesterolemia (p = .0088) in this study, that was similar to results obtained by (Ntandou *et al*., (2009); Després *et al*, (2000)). The study population has a mean BMI 30.63 ± 7.12 kg / m^2, forming a higher than normal value. It was virtually the same as that obtained by Riediger *et al*., (2011) in a Canadian population (30 kg / m^2). This result was superior to that obtained (22.76 ± 8.9 kg / m^2) by Jaffer *et al*., (2002). Indeed, the various topics selected in these groups are not subject to the same daily requirements and do not have the same eating habits which would probably be the justification for the observed difference. Family history not constitutes a significant parameter influencing cholesterol in this study. On the one hand, they are often ignored and underestimated, but especially in contrast to rich countries, they probably do not have the same impact because atherosclerotic diseases mainly affect new generations that are affected in the epidemiological transition. This is a parameter to consider in the coming years.

Conclusion

This study contributes to a better understanding on the lipid profile of patients treated in the cardiology department at the Army Instruction Hospital of Parakou. It shows that feeding behavior has a significant influence on the lipid profile. It was also shown an association of high cholesterol and other risk factors: diabetes, abdominal obesity, fruit and vegetable consumption and type of meal with atherosclerosis. It should be emphasized that food hygiene is essential for better management of cardiovascular disease.

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