WEST AFRICAN JOURNAL OF MEDICINE

ORIGINAL ARTICLE

Relationship between Waist Circumference and Cholesterol in Central Africans with Congestive Heart Failure

Relation entre tour de taille et cholesterol chez les africains du centre avec insuffisance cardiaque congestive

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ABSTRACT

BACKGROUND: **There are controversies as to what the traditional risk factors for coronary heart disease should be in sub-Saharan Africa.**

OBJECTIVE: **To assess the relationship between cholesterol and cardiovascular disease risk factors including Helicobacter pylori infection in black Africans with congestive heart failure.**

METHOD: **A cross-sectional and observational study of 48 men and 52 women.**

RESULTS: **Congestive heart failure was associated with abdominal obesity, hypertension, chronic renal failure, moderate levels of low HDL-C, excessive alcohol intake and hyperuricaemia, but low levels of cholesterol and triglycerides. TC was related by Univariate analysis with red cells, glucose, weight, waist circumference with HDL-C, CRP, fibrinogen and IgG antibodies against H pylori. Multivariate analysis revealed that waist circumference (B=0.688) and HDL-C (B=0.826) were the significant determinants of TC. There was a respective U-shaped relationship between CVD (P>0.05), chronic renal failure (P<0.05), H pylori-induced chronic gastritis (P<0.05) and the HDL-categories. Ischemic stroke and myocardial infarction were significantly (p<0.05) associated with low HDL-C, respectively. Clinical insulin resistance (P<0.01) was predominantly more common in the intermediate HDL-C category than in low and high HDL-categories. There was an inverse relation between lower TC: HDL-C ratio, high HDL-C and abdominal obesity/ insulin resistance in men. H. pylori gastritis was positively related to higher TC: HDL-C ratio in both men and women.**

CONCLUSION: **Preventive measures, more studies on the interplay between HDL-C level and its function and a specific ethnic definition of metabolic syndrome in the African are needed.** WAJM **2007; 26(3): 183 – 190.**

Keywords: **Africans, Atherosclerosis, HDL Cholesterol, reverse epidemiology, metabolic syndrome, heart failure.**

RESUMÉ

Contexte: *Les controverses demeurent sur le rôle des facteurs de risque cardiovasculaire dans la maladie coronaire en Afrique sub-Saharienne.*

Objectif: Evaluer la relation entre le cholestérol et les facteurs de risque cardiovasculaire dont l'infection à helicobacter pylori chez les noirs africains avec insuffisance cardiaque congestive.

Méthodes: *Etude transversale et observationnelle chez 48 hommes et 52 femmes.*

Résultas: *Il y avait une association entre l'obésité abdominale, l'hypertension, l'insuffisance rénale chronique, des taux un peu bas de HDL-C, d'excès d'alcool, l'hyperuricémie, les taux bas de cholestérol, les taux bas de triglycérides et l'insuffisance cardiaque congestive. Le cholestérol total était corrélé aux valeurs de globules rouges, glycémie, poids, HDL-C, CRP, fibrinogène et anticorps IgG contre H.pylori. en analyse multivarié. Le tour de taille (B=0,688) et HDL-C (B=0,826) étaient lesq déterminants significatifs du cholestérol total. Il y avait une relation en U entre les maladies cardiovasculaires (p>0,05), l'insuffisance rénale chronique (p<0,05), la gastrite chronique a H.pylori (p<0,05) et les catégories d'HDL. L'accident vasculaire cérébral ischémique et l'infarctus du myocarde étaient respectivement associés (p<0,05) au taux très bas de HDL-C. L'insulino-résistance clinique (p<0,01) était plus fréquente dans la catégorie intermédiaire de HDL-C. Il y avait une relation négative entre TC/HDL-C bas, HDL-C élevé et l'obésité abdominale/insulino-résistance chez les hommes. La gastrite à H.pylori était positivement associée à un taux élevé de TC/HDL-C chez les hommes et les femmes.*

Conclusion: *La prévention et des études supplémentaires sur l'interaction entre les taux de HDL-C et sa fonction et une définition du syndrome métabolique spécifique à l'Afrique sont souhaitées.* ***WAJM 2007; 26(3): 183 – 190.***

Mots-clés: Africains, athérosclérose, HDL Cholesterol, épidémiologie inverse, syndrome métabolique, insuffisance cardiaque.

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Abbreviations: BMI, body mass index; CHD,coronary hreat disease; CRP,c-reactive protein; CVD, cardiovascular disease; HC, hip circumference; HDLC, High density lipoprotein cholesterol; Hp, Helicobacter pylori; HR, Height ratio; LDLC, LDL-cholesterol; TC, total cholesterol; WC, waist circumference; WHR, waist hip ratio.

INTRODUCTION

Non-communicable chronic diseases including cardiovascular diseases (CVD), obesity, diabetes mellitus and cancers are the leading causes of morbidity, disability, mortality and health care expenses in both developed and developing countries[1] such as the areas of sub-Saharan Africa.

In sub-Saharan Africa, including our country the Democratic Republic of the Congo (DRC), the emerging epidemic of CVD with arterial hypertension as corner stone, is accelerating because of rapid economic growth (1950–1960 period), urbanization, ageing (epidemiologic transition, demographic transition) and lifestyle changes/diets of the population. So, infectious and nutrition deficiencies are declining in sub-Saharan Africa. In developed countries, high serum levels of total(TC) and low-density lipoprotein cholesterol, hypertriglyceridemia, and low levels of high density lipoprotein were found to be associated with increased risk of atherogenesis(CVD)[2].

Established risk factors of CVD, such as cigarette smoking, hypercholesterolemia, diabetes mellitus, and obesity do not completely explain the occurrence and the epidemic trend of arterial hypertension and CVD in these Africans with favourable lipid, lipoprotein and apolipoprotein risk profile[3,4]. It was stated therefore that hypertensive blacks seem readily to go into heart failure in the absence of coronary heart disease. Furthermore, in both healthy and hypertensive black Africans, having low total cholesterol and high HDL-Cholesterol levels[5], there was a positive correlation between the total serum cholesterol and HDL-cholesterol in urban Zulus ($P<0.004$)[5] and in urban Congolese hypertensives ($P<0.001$)[3]. In a recent series of 205 Congolese outpatients with cardiovascular complaints, lower levels of HDL-cholesterol and higher levels of systolic blood pressure, triglycerides, uric acid, fibrinogen, hematocrit, glucose, arterial hypertension, total cholesterol≥ 200mg/dL, uric acid≥ 7mg/dL, overweight, overall obesity, and abdominal obesity were associated with Helicobacter pylori-induced chronic gastritis and seropositivity to H.pylori[6], respectively. This is the reverse epidemiology of traditional risk factors in patients with chronic heart failure[7] and chronic renal failure under dialysis. Thus, deficiency[1] in cholestery ester transfer protein(CETP) could be studied in Africans with increased rates of arterial hypertension and CVD, despite the elevated HDL-cholesterol levels as reported among Japanese men[8]. Moreover, acceleration of reverse cholesterol transport, antioxidant activity, and anti-inflammatory action might play a key role in reducing the development of atherosclerosis[9]. The reduction in sodium-lithium counter transport of blacks prone to hypertension, is explained by their low total cholesterol and elevated HDL-cholesterol levels, respectively[10]. The cardiovascular risk in Africans with heart failure could be paradoxical and dependent on genetic and environmental (infection, inflammation, epidemiologic and nutrition transitions, obesity, physical inactivity) factors. The relation, therefore, between categories of HDL-cholesterol (lower, intermediate, higher) and other coronary risk factors and CVD, is rather linear but paradoxical and much more curvilinear (U-shaped relationship). The purpose of this study was to assess the determinants of total cholesterol and HDL-cholesterol as well as to examine the U-shaped relationship of categories of HDL-cholesterol, if any, to arterial hypertension, chronic renal failure, excessive alcohol intake, smoking, overall obesity, abdominal obesity/clinical insulin resistance, type 2 diabetes mellitus, hyperuricemia, ageing, gender, anaemia, CVD, and Helicobacter pylori infection among black Africans with congestive heart failure.

METHODS

Design and eligibility. This observational and clinical study was carried out at LOMO MEDICAL Clinic of the Heart of Africa Cardiovascular Center in Kinshasa Limete, DRC, during the 2003–2004 period. The potential population of this study was all the adult patients with congestive heart failure attending LOMO MEDICAL clinic. A systematic method of sample selection was used to select every fourth patient attending the clinic and who was hospitalized.

The nature and procedures of the study were fully explained to the selected and included patients and the consent obtained according to the recommendations of Helsinki II Declaration.

Procedures: The Institutional review Board of the University of Simon Kimbangu Medical School approved the study protocol.

Questionnaire: Only an interviewer (A.M.HF) who was trained and standardised in administering the structured questionnaire was employed. The questionnaire required data including sex, age, the London School of Hygiene questionnaire for chest pain (Rose questionnaire) to elicit a previous or present history of angina pectoris or pain from myocardial infarction, medical history of arterial hypertension, type 2 diabetes mellitus , CHD, chronic renal failure, stroke, smoking habit, and alcohol intake.

The clinical and complete examination included also three measurements of blood pressure which was recorded electronically (Automatic oscillometric, DBP, Monitor Model HEM-705CP, OMRON, Japan) and anthropometric measurements for weight, height, waist circumference, and hip circumference.

Height was measured to the nearest cm (Soenhle, Bolton, UK) and weight to the nearest 0.1kg (Seca, North Bend, USA). BMI was calculated as weight(kg) divided by height squared(m^2). Waist and hip circumferences were measured to the nearest centimetre with a tape measure while the patient was standing.

A 12-lead resting ECG recording (Fukuda Denshi, Japan), a chest X-ray (Siemens, Germany) a two-dimensional and Doppler echocardiography (with a 3.5 MHz transducer and a General Electric Loqus MD ultrasound system, USA), a ultrasound view of abdomen (with a 5 MHz transducer and a General Electric Loqus MD ultrasound system, USA), a gastric endoscopy (6), CT scan studies and coronary angiograms (Dr Jefrey King, Morningside clinics,

Johannesburg, South Africa) were performed for each respondent patient.

Laboratory data. In the morning fasting blood samples for overnight 10–12 hours were drawn and collected by antecubital venipuncture in all study patients, to determine the hematologic parameters (automated cell counter by Hemascreen 18, haematology analyzer, Hospitex Diagnostics, Florence, Italy), serum urea (Biomerieux France), serum uric acid (Biomerieux France), plasma fibrinogen (Biomerieux France), serum creatinine (Biomerieux France), serum CRP (Biomerieux France), plasma glucose (Biomerieux France), Helicobacter pylori serology (ELISA; Pyloriset [R]EIA-GIII, ORION, Diagnostica, Espoo, Finland) and lipid/lipoprotein profile. Screen Master LIH D113 equipment (Hospitex Diagnostics, Florence, Italy) was the spectrophotomer used.

The determination of serum total cholesterol, HDL-cholesterol and triglycerides(TG) was performed, using enzymatic methods (Biomerieux,France), respectively. Plasma glucose levels were measured using the hexokinase-glucose-6-phosphate dehydrogenase method[11]. The laboratory of LOMO MEDICAL clinic is standardized according to the criteria of the Centers for Disease Control-National Heart, Lung, and Blood Institute Lipid Standardization Program[12]. LDL-cholesterol and creatinine clearance were calculated according to Friedwald and to Cockroft and Gault formulae, respectively.

Definitions

Ageing was defined for patients aged 60 year-old and over. Cigarette smoking was defined by the current and regular use of smoked manufactured Tobacco during the last 30 days before the present study[13]. Patients with excessive alcohol intake were characterized by a daily consumption of 5 drinks for women and 6 drinks for men[13].

Arterial hypertension was defined as mean SBP>140 mmHg and/or mean DBP> 90mmHg[14], and/or treatment with antihypertensive. Hypercholesterolemia was defined as fasting serum Total cholesterole>200mg/dL[15].

Type 2 Diabetes mellitus was defined as fasting plasma glucosee>126mg/dL[16] or a previous diagnosis of diabetes among patients aged >40 years. Overweight was defined as BMI>25kg/m² but <30kg/m², and general obesity as BMI >30kg/m².[17] The NICEP criteria (waist circumference> 102 cm for men and >88 cm for women) were applied to define abdominal obesity[16]. Abdominal obesity/Clinical Insulin Resistance was defined as waist circumferencee>94 cm according to our previous study[18].

Serum uric acid levels>7mg/dL defined hyperuricemia. Chronic renal failure was characterized by a creatinine clearance <90ml/min.

Subtype ischemic stroke was defined using CT scan studies. The diagnosis of CHD (angina pectoris, myocardial infarction, silent ischemic cardiopathy) was based on clinical, enzymatic, ECG, and coronary angiograms. ECG abnormalities were coded according to the revised Minnesota Code Manual.

The presence of Helicobacter pylori was revealed by both seropositivity to Helicobacter pylori (>20IU/mL) and histologically proven chronic gastritis with Helicobacter pylori from gastric biopsies using the Sydney System[19].

Statistical Analysis

Data are expressed as means ± standard deviation or percentages, and analysed with the SPSS package for Windows version 10.04). When appropriate, group comparisons used ANOVA was followed by Bonfferoni adjustment for multiple tests, Scheffe post hoc test and P for Trend calculation. The entry criterion in the multiple linear regression analysis was a univariate P<0.10.

HDL-cholesterol was stratified according to the following groups: lower (<40mg/dL), intermediate (40–59 mg/dL), and higher (>60mg/dL) HDL-cholesterol. To avoid colinearity, red cells were preferred to haematocrit and haemoglobin while two relevant multiple models were developed to predict the variations of Total cholesterol: with and without including HDL-cholesterol, hip circumference and urea. A value of P<0.05 was considered significant.

RESULTS

General characteristics

The study included 100 black patients with congestive heart failure (CHF): 48 men and 52 women. The general characteristics are displayed in Tables 1-3. Respective proportions of ageing (> 60 years) and malnutrition in the 100 patients were 50% and 8%.

Helicobacter pylori infection was present in 62% of patients . 37% were suffering from atherosclerosis-induced CVD: ischemic stroke in 8% and CHD in 29%. The aetiology of congestive heart failure proportions was therefore dominated by epidemic rate of ageing (> 60 years) and 25% of angina pectoris.

Sex impact. Compared with men, women were characterized by higher CRP (39.7 ± 24.3mg/L vs 29.8 ± 22.3mg/L; P<0.01), shorter height (1.610±0.079cm versus 1.697 ± 0.096cm; P<0.0001), lower creatinine clearance (76.2 ± 71.3mL/min versus 92 ± 34.9 mL/min; P<0.0001), and higher rates of chronic renal failure (65.8% versus 37.1%; P<0.01) and Helicobacter pylori-induced chronic histologically proven gastritis (71% versus 32%; P<0.01).

The levels of the rest of the study variables including total cholesterol and HDL-cholesterol were similar (P>0.05) for both men and women (results not presented).

The rates of abdominal obesity/ clinical insulin resistance in men were positively (P for Trend=0.025) related to the HDL-cholesterol groups: 20.8% in low HDL-cholesterol, 52.9% in intermediate HDL-cholesterol, and 60% in high HDL-cholesterol. The NCEP-ATPIII cut off (waist circumference > 102 cm) of abdominal obesity in men was not associated (P>0.05) with HDL-cholesterol groups: 87.5% in low HDL-cholesterol, 94.1% in intermediate HDL-cholesterol, and 100% in high HDL-cholesterol.

The rates of abdominal obesity/ clinical insulin resistance (29.4%),%, 60%, 50%) and NCEP-ATPIII cut off (waist-circumference >88cm) of abdominal obesity (88.2%, 90% and 100%) in females were not significantly (P>0.05) associated

with HDL-cholesterol groups, respectively.

In men, the total cholesterol: HDL-cholesterol ratio was paradoxically lower (P=0.027) in the presence of abdominal obesity/clinical resistance (3.2 ± 1.5) than absence of clinical insulin resistance (5 ± 2.1). And for these men, total cholesterol: HDL-cholesterol ratio was not (P>0.05) associated with CVD (3.6 ± 2.1 versus 4.2 ± 2) and chronic renal failure (4.7 ± 2.3 versus 3.5 ± 1.5); whereas this total cholesterol: HDL-cholesterol ratio was significantly (P<0.05) higher in presence of Helicobacter pylori-induced chronic gastritis (5.2 ± 1.9) than absence of Helicobacter pylori-induced chronic gastritis (2.7 ± 1.3).

For women, total cholesterol: HDL-cholesterol ratio was positively (P<0.05) associated with Helicobacter pylori-induced chronic gastritis (4.9 ± 2 versus 2.8 ± 1.9) but not (P>0.05) with CVD (4.1 ± 1.1 versus 4.9 ± 4.5), chronic renal failure (4.7 ± 3.9 versus 4.3 ± 1.4), and abdominal obesity/clinical insulin resistance (5.6 ± 5.2 versus 3.9 ± 1.1).

Univariate and multivariate analysis for total cholesterol

Simple correlation coefficients between risk factors are summarised in table 4. In the first model of the multivariate linear regression, Waist circumference was the only significant (P<0.0001) determinant which accounted for 25.3% of the variation in Total cholesterol (R^2 adjusted for glucose, weight and red cells): Y=57.071 + 0.971 waist circumference. And in the second model of the multivariate linear regression, waist circumference and HDL-cholesterol (P<0.0001) were the major and significant correlates of total cholesterol, and together accounted for 35.3% of the variation in Total cholesterol (R^2 adjusted for hip circumference, weight, glucose, urea and red cells): Y= -49.121 + 0.688 waist circumference+0.826 HDL-cholesterol.

Multivariate analysis for HDL-cholesterol

Adjusted for red cells, waist circumference, height and creatinine clearance, 31.2% of variation (R^2) in HDL-cholesterol were paradoxically explained by the increase of total cholesterol (P<0.00001) and BMI considered as its determinants: Y=-5.937 + 0.160 Total cholesterol +0.886 BMI.

Table 1: Age, haematologic and anthropometric parameters in the study population

Variable	Mean ± SD	Range
Age (years)	57.2 ± 14.6	31 to 88
White cells count (10^6/mm^3)	4.3 ± 0.3	3.5 to 4.9
Haematocrit (%)	27.8 ± 7.9	12 to 51.9
Haemoglobin (g/dL)	9.3 ± 2.6	4 to 17.3
Weight (kg)	68.6 ± 17	40 to 129
Height (m)	1.652 ± 0.097	1.450 to 1.880
BMI (kg/m²)	25.2 ± 508	14.7 to 44.6
Waist girth (cm)	84.9 ± 22.7	45 to 147
Hip girth (cm)	61.8 ± 25.6	18 to 150
Waist-hip ratio	1.6 ± 0.8	0.43 to 5
Waist-to-height ratio	0.566 ± 0.144	0.28 to 1

Table 2: Parameters as Components of the Metabolic Syndrome in the Study Population

Variable	Mean ± SD	Range
Haemodynamic variables		
SBP (mmHg)	154 ± 37.3	80 to 270
DBP (mmHg)	98.5 ± 65.4	50 to 184
Metabolic variables		
Glucose (mg/dL)	109.2 ± 60.7	57 to 517
Uric acid (mg/dL)	7.2 ± 3.2	1.2 to 19.2
Urea (mg/dL)	12.2 ± 6	1.7 to 34.3
Creatinine (mg/dL)	1.1 ± 0.657	0.1 to 7
Total cholesterol (mg/dL)	139.5 ± 43.8	65 to 260
HDL-cholesterol (mg/dL)	38.7 ± 18.5	4.6 to 89

Table 3: Frequency of traditional cardiovascular risk factors in study population

Variable	Number (%)
Major components of metabolic syndrome	
• Abdominal obesity/NCEPIII	38(38)
• Clinical Insulin resistance	38(38)
• WHR >0.9	90(90)
Arterial hypertension	92(81)
Chronic renal failure	62(62)
Low HDL-cholesterol	
• < 40 mg/dL	68(58)
• < 35 mg/dL	52(52)
Excessive alcohol intake	54(54)
Uric acid >" 7 mg/dL	53(53)
Smoking	31(31)
BMI>30 kg/m²	25(25)
Type 2 Diabetes mellitus	20(20)
Overweight	17(17)
Total cholesterol >200 mg/dL	10(10)

The highest rates of Clinical Insulin-Resistance were significantly (p<0.01)were within the intermediate HDL-cholesterol group. Cases of ischemic stroke were more (P=0.08) frequent in the low HDL-cholesterol group, 7(12.1%), than in the intermediate HDL-cholesterol 1(3.7%) and the higher HDL-cholesterol group (0% n=0). All the cases of myocardial infarction were among patients with low HDL-cholesterol group. The mean levels Immunoglobin G antibodies against Helicobacter pylori negatively varied unequally and significantly (P<0.0001) between the HDL-cholesterol groups: the higher levels (1956 ± 59.8 IU/mL) within the lower HDL-Cholesterol group, the lower levels (40 ± 11 IU/mL) within the intermediate HDL-Cholesterol group, and the intermediate levels (390 ± 51 IU/mL) within the higher HDL-cholesterol group.

U-shaped relationship between HDL-cholesterol groups and certain variables

Figure 1 shows a non significant (P>0.05) and U-shaped relationship between rates of CVD and the groups of HDL-cholesterol in the total population and men whereas rates of CVD in women for low and intermediate HDL-cholesterol were the double for that of high HDL-cholesterol.

There was a respective and significant U-shaped relationship between the rates of chronic renal failure

(P<0.05), the proportions of Helicobacter pylori-induced chronic and histologically proven gastritis (P<0.05) and HDL-cholesterol groups (Figure 2).

Triglycerides and LDL-cholesterol.

Levels of triglycerides and LDL-cholesterol were very low and without cases of hypertriglyceridemia and significant association with any variable (results not presented).

Table 4: Relation between Markers of infection and inflammation vs total cholesterol

	Correlation coefficient, r				
	TC	CRP	HDLC	Fibrinogen	IgG VHp
TC		0.675*	0.498†	0.474*	0.834†
WC	0.503*	0.782†	0.421†	0.654†	0812†
WHR	0.473†				
Waist-to-HR	0.473†				
HDLC	0.498*	0.862†		0.842†	-0.573†
Glucose	0.205*	0.205*		0.352*	0.478†
Weight	0.416*	0.184*	0.527**	0.191*	0.195*
Red cells	-0.265*	0.201*	-0.202*	0.182*	0.04
Urea	0.473*	0.124		0.762	0.187*
Height			0.216*		
HC	-	0.094		0.076	0.194*
TC		0.675*	0.498†	0.474*	0.834†

CRP,c-reactive protein; HC, hip circumference, HDLC, High density lipoprotein cholesterol; Hp, Helicobacter pylori ; HR, ;Height ratio ;TC, total cholesterol; WC, waist circumference; WHR, waist hip ratio, * p<0.05, † p<0.01.

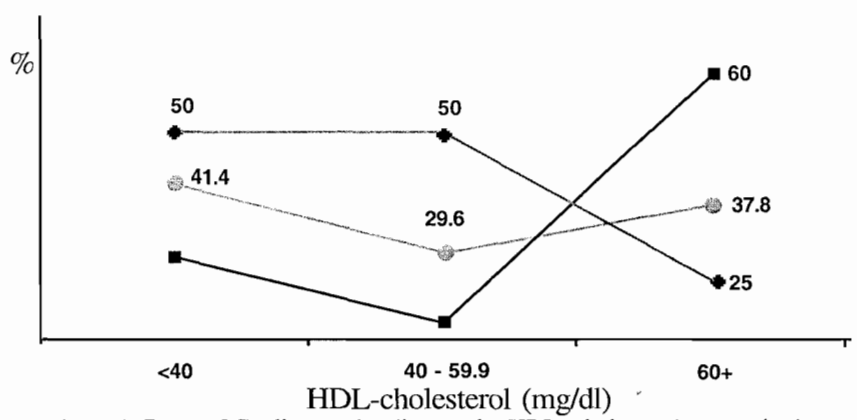

Figure 1: Rates of Cardiovascular diseases by HDL- cholesterol groups in the total population (●—●), in the men (■—■) and the women (◆—◆). There were 24, eight and six subjects respectively in the HDLC groups <40 mg/dl, 40-59.9 mg/dl and >60 mg/dl.

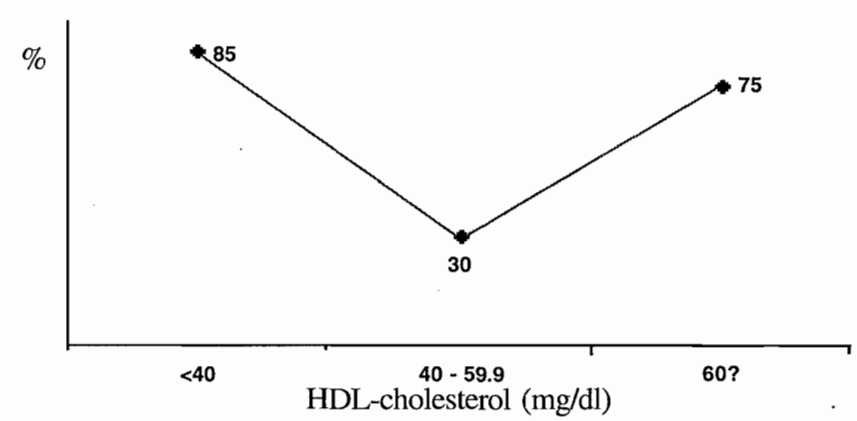

Figure 2: Distribution of rates of chronic renal failure and H. pylori-induced gastritis (CHG) according to the HDL- cholesterol groups.

DISCUSSION

Epidemiologic and clinical spectrum of patients

Epidemiologic[20] transition-related changes in lifestyle, westernisation and migration to an urban or peri-urban environment may explain emerging rates of smoking, alcohol intake, type 2 diabetes mellitus , overweight/overall obesity, clinical insulin resistance and low HDL-cholesterol as well as epidemic and prominent rates of arterial hypertension, abdominal obesity (WHRI>0.9), hyperuricemia, and chronic renal failure are important factors to be considered.

The main observations of this study are related to the reverse epidemiology, inflammation, infection and clinical insulin resistance in patients with chronic heart failure[7] and chronic renal failure. The distribution of the majority of men within the intermediate category of HDL-cholesterol as well as the reverse epidemiology of HDL-cholesterol render the protective role of high HDL-cholesterol pose questions deserving of further work to provide the answers..

Arterial hypertension and coronary heart disease

Arterial hypertension and coronary heart disease are among the aetiologies of congestive heart failure. In the recent past, hypertensive Africans went into heart failure in the absence of coronary heart disease.

The present emerging rate of CHD seems to be determined by many traditional[2] and new (infection)[6] risk factors conditioned on the presence of a nutritional-metabolic milieu (high intake of saturated fat) and reverse epidemiology[7]. The risk factors interact in a synergistical manner rather than being additive[3].

In the meantime, what can we do about the growing epidemic of CVD in Congolese with congestive heart failure? Several measures are possible and appropriate. First, aggressively manage conventional cardiovascular risk factors in these patients: to identify patients who are suitable for primary prevention, we must decide whether to treat specific risk

factors such as increased blood pressure or Helicobacter pylori infection[6].

Total cholesterol, HDL-cholesterol TC:HDL-C and clinical insulin resistance/abdominal obesity

Although CVD risk starts to increase from low levels of lipoproteins and triglycerides, the conventional criteria of hypercholesterolemia, low HDL-cholesterol, hyper-LDL-cholesterolemia, and hypertriglyceridemia were used for descriptive purposes. However, waist circumference > 94cm, equivalent to criteria of NCEP[15], the optimal threshold in predicting arterial hypertension and metabolic syndrome in the Congolese community[18], was used to define clinical Insulin resistance/ abdominal obesity in this study. Waist circumference >94cm (90thpercentile) for both men and women, corresponds with the general population of Kinshasa town, the capital of our country DRC[21].

In another multivariate model, both waist circumference and HDL-cholesterol were the main determinants of total cholesterol of these patients. The strongest and positive association between total cholesterol and HDL-cholesterol observed in these patients with congestive heart failure (B=0.826;P<0.0001) is similar with that (B=0.890;P<0.001) reported among hypertensive blacks from the same Kinshasa town[3].

In considering HDL-cholesterol as a dependent variable, only total cholesterol and BMI were its main major determinants. The latter associations suggest that the higher the total cholesterol and the HDL-cholesterol, the higher the risk of the metabolic syndrome; as in Univariate analysis there was a significant and positive correlation with the main components of the metabolic syndrome: between waist circumference and HDL-cholesterol; between glucose, waist circumference, and total cholesterol. The much-debated thrifty gene hypothesis[22] proposes that genetic variants that were protective and enhanced survival in rural areas with less abundant calories are now harmful because of increased caloric intake after migration from rural to urban areas. African-American-Caucasian American HDL-cholesterol variability was partially explained by true genetic differences, diet and social class[23].

The negative correlation between total cholesterol and red cells explains why low serum total cholesterol is a risk factor of haemorrhagic stroke in certain individuals[24] and hyperviscosity (elevated hematocrit) is a risk factor of stroke in Congolese patients[25]. In another part, the negative correlation between HDL-cholesterol and red cells, and that between HDL-cholesterol and IgG antibodies titers against Helicobacter pylori suggest that both higher low HDL-cholesterol are risk factors in certain conditions among sub-Saharan Africans. Recently, Helicobacter infection significantly correlated with low HDL-cholesterol and all the components of the metabolic syndrome, predicted the occurrence of arterial hypertension, ischemic stroke and CHD in Congolese patients[6]. As the lack of hypertriglyceridemia, hypercholesterolemia and hyper LDL-cholesterolemia do not explain the presence of high rates of arterial hypertension and CVD in these black Congolese, inflammation and, possibly commoner infectious diseases in sub-Saharan Africa, and proinflammatory effect of cytokines and HDL-cholesterol seem to be critical in initiation, early stage and progression of atherosclerosis[6]. In this study, the markers of inflammation (CRP and fibrinogen) were positively correlated with total cholesterol, waist circumference, HDL-cholesterol, glucose, weight and red cells, respectively.

Levels of HDL-cholesterol and its major protein, apo-lipoprotein A-I, have been shown consistently to be negatively correlated with CHD risk [26].

Helicobacter pylori infection

Altered levels of paraoxonase, platelet-activating factor acetylhydrolase, ceruloplasmin, and apof in HDL during acute influenza infection cause HDL to lose its anti-inflammatory properties[27]. Cholesteryl ester transfer protein (CETP) deficiency is related to increased prevalence of CHD in Japanese-American men after migration, despite the resulting elevated HDL-cholesterol levels[8]. In our patients with Helicobacter pylori infection, serum paraoxonase-1(PON1) activity could be related to decrease in HDL-cholesterol and, in part, to elevated oxidative stress and inflammatory condition as reported in Turkey[28].

U-shaped relationship between categories of HDL-cholesterol and CHD risk

Clinical Insulin resistance/ abdominal obesity and men were more frequent within the intermediate HDL-cholesterol category. This is logical in the general population of Kinshasa town where the mean of the waist circumference of men is significantly higher than that of women[21]. The difference in CHD prevalence is higher in men with intermediate HDL levels (40-60 mg/dL)[8]. The highest rates of ischemic stroke and myocardial infarction were present within the low HDL-cholesterol group according to the consistent and inverse correlation between HDL-cholesterol and CHD risk[26].

However, a respective U-shaped relationship was demonstrated between the proportions of women, atherosclerotic CVD, chronic renal failure, Helicobacter pylori-induced histologicaly proven chronic gastritis and the categories of HDL-cholesterol: the highest proportions being observed within both low and high HDL-cholesterol categories.

Proposed explanations for these apparently disparate observations are that initiation and progression of atherosclerosis in black Africans in course of nutrition transition are more influenced by the sex (genetics) mediated biology of inflammation/infection, clinical insulin resistance and renal dysfunction than transient inexistent dyslipidaemia and categories of HDL-cholesterol.

Although certain patients with stroke and myocardial infarction were more frequently found in the low HDL-cholesterol category, we invite African clinicians to consider low HDL-cholesterol a cardiac risk correlate rather than a direct treatment target, because it is seen in cluster with other metabolic abnormalities including abdominal obesity, insulin resistance, pro-

inflammatory and pro-thrombotic states[29] and increased coronary risk[30].

Limitations

Some bias may be due to this hospital-based study. The generalizability of our results is uncertain. However, this was a randomized series study not necessitating controls and general population as dyslipidemia, hypercholesterolemia and cardiovascular risk factors are uncommon in black African population. The small size of the study might explain the absence of non significant difference in certain variables and render questionable someof the interpretations. The lack of quantification of excessive alcohol intake, vegetables and physical activity limited the interpretation of high levels of HDL-cholesterol.

CONCLUSION

We need specific ethnic and gender cut-points of components of metabolic syndrome (abdominal obesity and dyslipidaemia) and more preventive strategies and studies to understand the interplay between HDL-cholesterol level and HDL-C function for developing optimal HDL-modifying drugs.

AKNOWLEDGMENTS

This work was supported by a grant from LOMO MEDICAL CENTER, Kinshasa Limete, DRC. We thank Guy MILONGO for technical assistance in the manuscript preparation.

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