



*Full Length Research Paper*

# Prevalence and factors associated with dyslipidemia among menopausal women in the city of Parakou (Benin)

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## ABSTRACT

Cases of dyslipidemia associated with menopause increase risk for cardiovascular diseases during that period of life. The purpose of this study was to determine the prevalence and factors associated with dyslipidemia among menopausal women in the city of Parakou. It was a cross-sectional study with descriptive and analytical purpose, which had been carried out from 20 February to 20 May, 2016 in Parakou (Benin). Lipid parameters were measured in 379 menopausal women. The criteria of the National Cholesterol Education Program Adult Treatment Panel III were used to identify dyslipidemia cases. The overall prevalence of dyslipidemia was estimated at 86.98%. The different types of dyslipidemia which were identified were: hypercholesterolemia (53.03%), LDL hypercholesterolemia (47.72%), hypertriglyceridemia (29.02%), HDL hypocholesterolemia (25.33%), mixed hyperlipidemia (17.94%) and atherogenic dyslipidemia (2.34%). Abdominal obesity ( $p=0.03$ ) was significantly associated with hypercholesterolemia. Alcohol excessive drinking was significantly associated with HDL hypocholesterolemia ( $p=0.00$ ). Obesity ( $p=0.03$ ) and history of diabetes mellitus ( $p=0.00$ ) were significantly associated with hypertriglyceridemia. Obesity ( $p=0.02$ ) was significantly associated with mixed hyperlipidemia. Prevalence of dyslipidemia in the menopausal women of Parakou is high. Preventive measures must be implemented in order to reduce those abnormal lipid parameters.

**Keywords:** Dyslipidemia, menopause, cholesterol, associated factors, Benin

## INTRODUCTION

Dyslipidemia represent a leading cause of cardiovascular diseases which are conducive to morbidity and mortality in men as well as in women (Castelli, 1988). As the current leading cause of female mortality, cardiovascular diseases are on the rise in the menopausal woman, because, not only of increase in life expectancy, but also of emergence of new risk factors such as tobacco

smoking, obesity, sedentary lifestyle, hypercholesterolemia and eating habits (Solimene, 2010).

Menopause is the state of absence of menstruations at the end of the reproductive age resulting from loss of ovarian follicular activity. The effects of hormonal changes associated with menopause on serum lipids play

important roles in the cardiovascular diseases associated with menopause. The incidence of cardiovascular diseases increases in menopausal women (Kanwar et al., 2014).

There are several current consistent studies that suggest an increase in coronary risk largely associated with the evolution of lipid parameters, after menopause. Actually, compared to premenopausal women, menopausal women present an increase in concentrations of LDL cholesterol, total cholesterol and apolipoprotein B (Bonithon-Kopp et al., 1990 ; Wu et al., 1990). Framingham study documented increase in cholesterol concentrations coinciding with menopause, thus suggesting that menopause contributes to lipid parameters modifications (Hjortland et al., 1976).

Menopause is therefore the transition from a low-risk situation to a situation of high risk for atheromatosis. Data are available on dyslipidemia during menopause in the West and in Asia, but little is known about the topic in Africa in general and in Benin in particular.

This study aimed to determine the prevalence and factors associated with dyslipidemia among menopausal women living in the town of Parakou.

## **MATERIAL AND METHODS**

### **Study setting**

This study had been conducted in the town of Parakou (Republic of Benin) where subjects were selected and in the Biochemistry laboratory of the Borgou/Alibori Regional University Teaching Hospital for the handling of biological samples.

### **Type and period of study**

We performed a cross-sectional study with descriptive and analytical purpose based on prospective collection of data, from 20 February to 20 May, 2016.

### **Study target population**

The study target population consisted only of women selected after their informed, read and approved consent expressed in the town of Parakou. Parent population consisted of women living in Parakou. As far as target population is concerned, it consisted of menopausal women of Parakou. The study involved women in period of menopause (those who did not have their menstruation for at least one year), who had given their free and informed consent to participate to the study and living in Parakou for at least three years. As they did not provide their free and informed consent to participate to the

research work, women with surgical menopause and on drug therapy were not involved in the study.

### **Sampling**

We performed a two-stage cluster sampling. The first stage consisted in selecting women associations existing in the town of Parakou; it was done through random draw without replacement. The second stage concerned selection of subjects meeting our inclusion criteria. A total of 379 women were selected.

### **Variables**

The dependent variables were serum concentrations of total cholesterol, HDL cholesterol, LDL cholesterol and triglycerides. The independent variables were sociodemographic, field-related factors, behavioral factors, factors associated with menopause and anthropometric factors.

### **Data collection**

Data were collected using a questionnaire drafted for this purpose, a metric height gauge, a bathroom scales, a mechanical weighing scales and a blood sampling. The questionnaire had been administered to each selected woman meeting the inclusion criteria, after explaining the study's objective and getting her informed consent during the survey period. Then, weight, size, waist circumference and blood pressure were measured. Eventually, we collected a venous blood sample to measure lipid parameters.

Weight was taken using a Homday® mechanical weighing scales of maximum capacity of 150 kg with 0.5 kg accuracy, placed on a flat and firm surface. Size was measured using a mobile height gauge with 0.1 cm accuracy. Waist circumference was measured with a flexible, non elastic tape measure. Blood pressure was measured according to the standard procedure recommended by the World Health Organization for such surveys. It was measured in the respondent resting and sitting during 15 minutes, with a OMRONR HEM-907 automated digital blood pressure monitor equipped with an adapted cuff.

### **Blood sampling**

Blood samples (4 mL) were obtained by superficial venous puncture below the blood pressure cuff around the arm in dry tubes, from each respondent fasting for a minimum 12 hours. Blood samples thus obtained were centrifuged at 4000 rpm during 5 minutes, and then

**Table 1.** General characteristics of menopausal women, (Parakou, February-May 2016)

<b>Number</b>	<b>379</b>
<b>Mean age (years)</b>	56.45±9.26
<b>Mean body mass index (kg/m<sup>2</sup>)</b>	30.00±6.02
<b>Mean waist circumference (cm)</b>	98.72±14.66
<b>Mean systolic blood pressure (mmHg)</b>	147.87±26.01
<b>Mean diastolic blood pressure (mmHg)</b>	89.93±16.07
<b>Mean age at onset of menopause (years)</b>	47.35± 6.22

serums were decanted. The latter were used on the same day to measure lipid parameters.

### Measuring lipid parameters

On each blood sample, the following measurements were done: total cholesterol, HDL cholesterol and triglycerides. The level of total cholesterol (TC), HDL cholesterol and triglycerides was determined through endpoint enzymatic method. TC was measured through cholesterol oxidase assay (Mac Lachlan et al., 2000); TG was measured with glycerol phosphate oxidase (Solena, 2000). As regards HDL-C, it was measured with the method of phosphotungstic acid precipitation in the presence of magnesium ions (Warnick et al., 1979). LDL- C serum concentration was estimated by calculation using the formula of Friedewald et al. (1972) if TG does not exceed 3.4 g/L.

### Assessment criteria

Types of dyslipidemia were defined according to the criteria of the National Cholesterol Education Program Adult Treatment Panel III (NECP ATP III) (NCEP, 2001): hypercholesterolemia: total cholesterol > 2 g/L; HDL hypocholesterolemia: HDL cholesterol < 0.40 g/L; hypertriglyceridemia: triglycerides > 1.50 g/L; LDL hypercholesterolemia: LDL cholesterol > 1.30 g/L; mixed hyperlipidemia: total cholesterol > 2 g/L and triglycerides > 1.50 g/L; atherogenic dyslipidemia: HDL cholesterol < 0.40 g/L, triglycerides > 1.50 g/L and LDL cholesterol > 1.30 g/L.

### Data analysis

Quantitative data processing was carried out using Epi Info 3.5.1 CDC software. Findings were presented in the form of percentages with 95% confidence interval and in the form of averages with standard deviation. Chi-square and FISCHER statistical tests were used as the case may be to compare ratios. Mean values of dyslipidemia were compared by means of analysis of variance

(ANOVA). The relationship between the dependent variable and the independent variables was measured using the relative risk (RR). A multivariate analysis was done by means of logistic regression to eliminate the factors of confusion between relationship measurements. Significance threshold was set at 0.05.

### Ethical considerations

The research protocol of this study has been registered under No. 419/2016 at the Faculty of Medicine of the University of Parakou. The study's objectives were explained to the subjects whose oral or written informed consent was obtained. This consent states that the respondents are not at risk if they refuse to participate in the study or stop their collaboration during the research work. The information collected were used and processed in complete confidentiality and with anonymity.

## RESULTS

### General characteristics of the study target population

The table 1 shows the general characteristics of the study target population.

### Prevalence of the different types of dyslipidemia

Overall prevalence of dyslipidemia cases was 86.98%. Hypercholesterolemia (53.03%), LDL hypercholesterolemia (47.72%) and hypertriglyceridemia (29.02%) were the predominant types of dyslipidemia (Table 2).

### Prevalence of different types of dyslipidemia according to age groups

The prevalences of hypercholesterolemia and LDL hypercholesterolemia were significantly higher in ]55 - 90] years' age groups ( $p = 0.00$  and  $0.01$ ) (Table 3).

**Table 2.** Prevalence of different types of dyslipidemia in menopausal women, (Parakou, February-May 2016) (N = 379)

	Number	Prevalence (%)	CI (95%)
Hypercholesterolemia	201	53.03	[47,74 - 58,13]
HDL Hypocholesterolemia	96	25.33	[21,09 - 30,08]
Hypertriglyceridemia	110	29.02	[24,56 - 33,92]
LDL Hypercholesterolemia	178	47.72	[42,57 - 52,92]
Mixed hyperlipidemia	68	17.94	[14,29 - 22,26]
Atherogenic dyslipidemia	9	2.34	[0,97- 4,24]

CI = Confidence Interval

**Table 3.** Prevalence of dyslipidemia according to age groups in menopausal women, (Parakou, February-May 2016) N=379

	Age groups (years)			p
	N	] 40 - 55]	]55 - 90]	
Hypercholesterolemia	201	91 (45.27)	110 (54.73)	0.00
HDL Hypocholesterolemia	96	57 (59.38)	39 (40.63)	0.07
Hypertriglyceridemia	110	58 (52.73)	52 (57.27)	0.46
LDL Hypercholesterolemia	178	84 (47.19)	94 (52.81)	0.01
Mixed hyperlipidemia	68	31(45.59)	37 (54.41)	0.08
Atherogenic dyslipidemia	9	6(66.67)	3(33.33)	0.21

Values are estimated in the form of numbers with percentages in brackets

**Table 4.** Factors associated with dyslipidemia in menopausal women, according to multivariate analysis, (Parakou, February-May 2016) N=379

	Types of dyslipidemia					
	HC	HDL-H	LDL-H	HBP	MH	AD
<b>Anthropometric parameters</b>						
Obesity	2.08 (0.55)	0.63 (0.88)	3.18 (0.36)	8.88 (0.03)*	9.06 (0.02) *	6.61 (0.08)
Abdominal obesity	4.38 (0.03)*	0.88 (0.37)	0.45 (0.49)	2.49 (0.11)	0.04 (0.82)	0.21 (0.64)
<b>Lifestyle</b>						
Alcohol Cons	2.44 (0.11)	10.82 (0.00)*	2.13 (0.14)	0.04 (0.82)	0.01 (0.90)	4.44 (0.03)*
Sedentary lifestyle	0.03 (0.85)	0.25 (0.61)	1.75 (0.18)	0.01 (0.91)	1.13 (0.28)	0.26 (0.58)
Fats	0.04 (0.82)	0.07 (0.77)	3.30 (0.06)	0.35 (0.55)	0.07 (0.78)	0.21 (0.64)
<b>Form of OOM</b>	2.08 (0.35)	0.67 (0.71)	1.85 (0.39)	0.20 (0.90)	3.54 (0.17)	3.05 (0.21)
<b>Age at OOM</b>	5.05 (0.02)*	3.41 (0.06)	0.98 (0.32)	0.15 (0.69)	2.47 (0.11)	0.19 (0.66)
<b>History of HBP</b>	0.93 (0.33)	0.00 (0.97)	0.02 (0.88)	2.69 (0.10)	4.10 (0.04)*	4.06 (0.04)*
Diabetes mellitus	0.46 (0.49)	1.02 (0.31)	0.11 (0.73)	7.38 (0.00)*	2.43 (0.11)	0.35 (0.54)

Values non in brackets : RR ; Values in brackets : p ; Alcohol Cons: alcohol excessive drinking; fats: excessive consumption of fats ; Form of OOM: form of onset of menopause ; Age at OOM: age at onset of menopause ; HC : Hypercholesterolemia ; HDL-H: HDL Hypocholesterolemia ; HT : Hypertriglyceridemia ; LDL-H : LDL Hypercholesterolemia ; MH: Mixed hyperlipidemia ; AD : Atherogenic dyslipidemia ; \*significant values at the threshold of 5%

### Multivariate analysis of factors associated with dyslipidemia

Abdominal obesity ( $p=0.03$ ) and age at onset of menopause ( $p=0.02$ ) were significantly associated with hypercholesterolemia. Alcohol excessive drinking was significantly associated with HDL hypocholesterolemia ( $p=0.00$ ). Obesity ( $p=0.03$ ) and history of diabetes mellitus ( $p=0.00$ ) were significantly associated with hypertriglyceridemia. Obesity ( $p=0.02$ ) and history of high blood pressure ( $p=0.04$ ) were significantly associated

with mixed hyperlipidemia. Eventually, alcohol excessive drinking ( $p=0.03$ ) and history of high blood pressure ( $p=0.04$ ) were significantly associated with atherogenic dyslipidemia. Table 4 shows those different relationships.

### DISCUSSION

#### Prevalence of the different types of dyslipidemia

In our research work, the overall prevalence of dyslipidemia was 86.98%. This prevalence is higher than

the ones reported in the literature. In Africa, Doupa et al. (2014) in Senegal found 63.8%; Osuji et al. (2010) and Odenigbo et al. (2008) in Nigeria reported 60.5% and 60.0% respectively. In the USA, Goff et al. (2006) reported an overall prevalence of dyslipidemia of 29.3%; in China in 2007, a survey had found 18.6% (Zhao et al., 2007). Therefore, the overall prevalence of dyslipidemia varies from one country to another.

In this study, the prevalence of hypercholesterolemia was 53.03%. This result is higher than those found by Sharma et al. (2013) in India i.e. 34%. It is also higher than those of Osuji et al. (2010) and Odenigbo et al. (2008) in Nigeria which were respectively 31.4% and 23% among adult populations. The prevalence of LDL hypercholesterolemia was 47.72% in our study. This prevalence is close to the one of Odenigbo et al. (2008) in Nigeria who had found 51%. By contrast, it is higher than the one of Ogbonna et al. (2013) in Nigeria i.e. 37.1%. Our study pointed out a prevalence of hypertriglyceridemia estimated at 29.02%. This prevalence is lower than the one of Osuji et al. (2010) in Nigeria who had found 34.1%. However, our result is higher than the one reported by Sharma et al. (2013) who found 16.60% in India and the one of Odenigbo et al. (2008) who found 5% in Nigeria. The results of this research work have demonstrated that the prevalence of HDL hypocholesterolemia was 25.33%. This prevalence was lower than the one of Gupta et al. (2008) in India who found 48.8% in women aged 40 to 49 years; but higher than the one reported by Sharma et al. (2013) in India which was 13.70%. Our research work has also highlighted a prevalence of combined hyperlipidemia estimated at 17.94%. This result is similar to the one of Carreau et al. (2008) among a Caucasian population, which was estimated at 19.5%, but higher than the one of Doupa et al. (2014) in Senegal who had found 1.97%.

Those differences may be due, on the one hand, to changes during menopause which cause an increase in serum concentrations of total cholesterol and LDL cholesterol (Jensen et al., 1990), and to women's lifestyle and eating habits which are variable from one region to another (Li et al., 2005). On the other hand, as the different types of dyslipidemia are asymptomatic, subjects almost never complain about them. It is therefore important to provide advices for appropriate eating, behavioral and physical habits; moreover, women should be advised to do systematic lipid test before menopause. These remarks suggest that menopause is a risk factor independent from cardiovascular diseases (Igweh et al., 2005).

In our study, the prevalences of hypercholesterolemia and LDL hypercholesterolemia were significantly higher in [55 - 90] years' age groups ( $p=0.00$  and  $0.01$ ). These remarks are consistent with data from the literature which suggest that menopause modifies serum lipids by reducing HDL cholesterol, and by increasing total cholesterol, triglycerides and LDL cholesterol (Kilim and

Chandala, 2013). These findings may be due to reduction of rate of circulating estrogens identified during menopause. Those alterations of lipid profile help explain the high incidence of cardiovascular diseases in menopausal women compared to those in genital sexual activity (Usoro et al., 2006).

### Factors associated with the different types of dyslipidemia

The results obtained in our study show that abdominal obesity was significantly associated with hypercholesterolemia ( $p=0.03$ ); obesity was significantly associated with hypertriglyceridemia ( $p=0.03$ ) and mixed hyperlipidemia ( $p=0.02$ ). These findings are similar to those of Chaudhuri et al. (2015) in India which reported that obesity and abdominal obesity were positively associated with hypertriglyceridemia, total hypercholesterolemia and LDL hypercholesterolemia ( $p<0.001$ ). Besides, obesity and abdominal obesity were also associated with dyslipidemia ( $p<0.01$ ) in a research work carried out by Doupa et al. (2014) in Senegal.

Epidemiological studies have noted that relationship between dyslipidemia and abdominal obesity is mediated by an etiological and pathological mechanism (Farnier, 2007). Dyslipidemia classically associated with abdominal obesity is characterized by an atherogenic metabolic triad including increased triglycerides, low HDL cholesterol and excess of LDL cholesterol fraction (Santos and Barros, 2003).

Alcohol excessive drinking was significantly associated with HDL hypocholesterolemia ( $p=0.00$ ), and atherogenic dyslipidemia ( $p=0.03$ ) in our research work. In the United States of America, Fan et al. (2006) had found a relationship between HDL hypocholesterolemia and alcohol drinking ( $p=0.00$ ). By contrast, in India, Chaudhuri et al. (2015) had not found out any significant correlation between the different types of dyslipidemia and alcohol abuse and addiction. The relationship between alcohol excessive drinking, HDL hypocholesterolemia and atherogenic dyslipidemia identified in our study increases the risk for cardiovascular disease. It is therefore necessary to take preventive actions in order to reduce intake of alcoholic drinks.

In our research work, history of diabetes mellitus ( $p=0.00$ ) was significantly associated with hypertriglyceridemia. In Nigeria, Jisieike-Onuigbo et al. (2011) had found that hypercholesterolemia and hypertriglyceridemia were significantly higher in diabetic subjects ( $p=0.003$ ). A particularly high residual risk for cardiovascular disease remains in those diabetic subjects.

History of high blood pressure (HBP) was associated with mixed hyperlipidemia ( $p=0.04$ ) and atherogenic dyslipidemia ( $p=0.04$ ). In Brazil, Freitas et al. (2011) had



identified a significant relationship between HDL hypocholesterolemia and HBP ( $p=0.00$ ). The HBP-dyslipidemia relationship noted in our research work increases cardiovascular morbidity and mortality (Gordent, 2006). Screening of HBP and different types of dyslipidemia before menopause may reduce cardiovascular risk in the menopausal woman.

Age at onset of menopause above 50 years was significantly associated with hypercholesterolemia ( $p=0.02$ ). In Japan, like in this study, Kimura et al. (2006) had highlighted the existence of positive and significant relationship between age at onset of menopause, hypercholesterolemia ( $p < 0.05$ ), LDL hypercholesterolemia ( $p < 0.05$ ) and hypertriglyceridemia ( $p < 0.05$ ). Endothelial dysfunction associated with age at onset of menopause may in part explain increased number of dyslipidemia cases among menopausal women. The rates of circulating estrogens are considerably lower in menopausal women with increased serum level of total cholesterol, triglycerides, LDL cholesterol and decline in HDL cholesterol (Dias et al., 1995; Schenck, 1996).

Like any descriptive survey, our study has some limitations. Indeed, data collection with questionnaire may lead to an underestimation or overestimation of data due to respondents' inevitable subjectivity. Moreover, there may be bias in the measurement of physical parameters (anthropometric measures and blood pressure). In this study, those physical parameters have been minimized due to their collection by only one person and to the use of the same measuring equipment. Despite those limitations, we believe the results we have achieved are valid.

## CONCLUSION

The prevalence of the different types of dyslipidemia in menopausal women of Parakou is high. Hypercholesterolemia, LDL hypercholesterolemia and hypertriglyceridemia are the predominant types of dyslipidemia. Obesity, abdominal obesity, alcohol excessive drinking, age of onset of menopause as well as history of HBP and diabetes mellitus are significantly associated with different types of dyslipidemia.

Therefore, this study shows that menopause modifies the values of lipid parameters, thus amplifying development of atheromatosis. Preventive measures must be implemented in order to limit those anomalies of lipid parameters.

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