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Living Environment and Hypercholesterolemia: Case of Mono and Couffo Departments, Benin, in 2015

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Abstract

Introduction: Studies conducted in Benin have often not emphasized the living environment underlying hypercholesterolemia. The objective was to study the prevalence and factors associated with hypercholesterolemia in the Mono and Couffo departments in 2015 with consideration of the living environment. **Methods**: Descriptive cross-sectional study with an analytical aim that involved 2490 subjects aged 18 - 69 years, selected using a three-stage randomized sampling technique. Data were collected using the Personal Digital Assistant (WHO STEPS instrument) and analyzed according to STEPS recommendations using Epi-Info7.1.5.0 and SPSS20 software. The Chi-square test was used to compare proportions and the difference was considered significant for $p < 0.05$. **Results**: Out of 2490 respondents, 60.20% were women. The mean age was 36.14 ± 12.82 years. The prevalence of hypercholesterolemia was 4.7% (95% CI: [3.88 - 5.54]) and lower in the Couffo. Factors associated with hypercholesterolemia after multivariate analysis were harmful alcohol consumption, high blood pressure, type 2 diabetes, obesity and overweight. **Conclusions**: Living environment was found to be one of the important factors to consider in strategies to control hypercholesterolemia in the Mono and Couffo departments.

Keywords

Benin, Hypercholesterolemia, Living Environment, Mono and Couffo Departments, Non-Communicable Diseases, Risk Factors

1. Introduction

Non-communicable diseases (NCDs) are currently the leading cause of death

worldwide. They kill 41 million people each year, representing 71% of deaths worldwide. NCDs, following the social gradient in their occurrence, have a disproportionate impact in low- and middle-income countries, which account for more than three-quarters of deaths due to these diseases [1] [2]. Approximately one-quarter of global NCD-related deaths occur before the age of 60 [2]. In African countries, NCDs are increasing rapidly and are projected to be a more common cause of death than communicable, maternal, perinatal, and nutritional diseases [2] [3] by 2030. However, a significant proportion of NCDs is preventable on the basis of common behavioural modifiable risk factors (RFs) such as smoking [4], poor diet, physical inactivity and harmful use of alcohol that promote overweight and obesity, hypertension and hypercholesterolemia, all of which depend on the individual's living environment [5].

Hypercholesterolemia is a major contributor to cardiovascular disease and is estimated to be responsible for 2.6 million deaths per year [6] [7]. It increases the risk of heart disease and stroke [8] [9]. But if nothing is done, it could become one of the largest NCD RFs in Africa, particularly in Benin [3].

Sustainable measures to prevent RFs and improve primary health care can prevent millions of premature deaths from these diseases [10] [11]. Surveillance, in the action plan for the Global Strategy to Combat NCDs, aims to monitor NCDs and analyze their socioeconomic, behavioral, and political determinants to guide policy, legislative, and financial measures. The World Health Organization (WHO) [9] urges Member States to consider the development of national targets and indicators based on the national situation.

Benin pays a heavy bill in terms of mortality and morbidity due to NCDs [12]. Half of the population carries at least two RFs of NCDs [12]. Knowing that health is created and experienced by people in their daily living environments which have a direct impact on their health and well-being and that individual choices regarding health and health behavior are made in the environments encountered in daily life [13], we studied the prevalence and factors associated with hypercholesterolemia in the Mono and Couffo departments in 2015. The goal is to contribute to the improvement of prevention and control of NCDs in the Mono and Couffo departments by taking into account the role that the living environment plays in the formulation of strategies.

2. Setting and Methods

2.1. Study Setting

The departments of Mono and Couffo are located in the South-West of Benin. Their populations in 2015 were estimated at 525,025 and 786,409 inhabitants respectively [14]. The department of Mono covers an area of 1605 km^2 and is composed of six municipalities and 276 villages. The branches of activity in the department of Mono are agriculture, fishing, hunting, trade, catering, accommodation and manufacturing industry. The department of Couffo covers an area of 2404 km^2 and is made up of six municipalities with a total of 367 villages. Its

populations are mainly involved in agriculture, livestock and fishing. They also carry out commercial activities and processing of agricultural products and handicrafts. Industry is almost non-existent [14].

2.2. Methods

The type of study was a cross-sectional descriptive study with an analytical focus. The study population consisted of all adults aged 18 to 69 years in the Mono and Couffo departments corresponding to the WHO age group for STEPS surveys. As inclusion criteria, subjects residing for at least 6 months in the intervention area and who gave their consent were included in the study. As exclusion criteria, subjects with major mental disorders who could not answer the questions were excluded from the study.

With respect to sampling, the sample size was estimated at 2499 participants in both departments. It was calculated using the formula designed by WHO for the calculation of the sample size in STEPS surveys. The source population was subdivided into 8 age/sex brackets (4 brackets for males and 4 for females). The size calculated according to the Schwartz formula was multiplied by 8 for the age/sex brackets and divided by 0.8 (80% response rate).

$$\text{Schwartz's formula: } n = \frac{k * Z\alpha^2 * p * (1-p)}{i^2} \text{ and } N = \frac{n * \Omega}{T}$$

(n (Schwartz formula sample size), $\alpha = 0.05$ (first species risk), $Z\alpha = 1.96$, $k = 1$ (cluster effect), $p = 50\%$ (multiple RFs), $i = 6.2\%$ (desired precision), N (expected sample size), $\Omega = 8$ (number of age/sex brackets), $T = 80\%$ (response rate).

$$n = \frac{1 * 1.96^2 * 0.5 * 0.5}{0.062^2} = 249.9 \quad N = \frac{n * \Omega}{T} = \frac{249.9 * 8}{0.8} = 2499$$

participants rounded up to 2500.

Data were collected using a three-stage random sampling technique. The sampling frame for the two departments involved was provided by the National Institute of Statistics and Economic Analysis. The first stage randomly selected 125 Enumeration Areas (EAs). In the second stage, 20 households per EA were drawn by systematic random sampling after enumerating all households in the EA. In the third stage, one individual per household drawn was selected using the WHO KISH method, either directly by the *Personal Digital Assistant* (PDA) or by manual KISH table. A structured individual interview was conducted with the participant. After the interview, each drawn participant was given physical measurements (weight, height, waist circumference, hip circumference, and blood pressure) on the same day at home and biological measurements (blood glucose and cholesterol) the next morning on an empty stomach at a health center or a place set up for this purpose in the EA. All these data were entered into the PDAs and on the participants' results sheet. At the end of the day, the completeness and consistency of the data were checked by the supervisors.

The collection tools consisted of : WHO STEPS instrument (last French electronic version V.3.1) with detailed information on socio-demographic factors, behavioral and biological risk factors and history of NCDs, BOSO MEDICUS UNO brand automatic digital blood pressure monitors with medium and wide cuff meeting WHO standards, SECA brand mobile blood pressure scales, EKS Professional brand adult mechanical scales, flexible graduated non-stretchable tapes, *Cardiocheck*® allowing measurement of both blood glucose and total cholesterol with blood glucose/cholesterol test strips. Physical and biological measurements were integrated and installed in the PDAs. These tools were tested, corrected and adapted prior to data collection (**Annex 1**).

The collection team consisted of 20 trinomials of investigators, each comprising two junior epidemiology technicians and a paramedic (nurse or laboratory technician), all of whom were trained in STEPS. The epidemiologists were responsible for enumerating households and mapping the EAs and administering the questionnaire (STEPS 1) using the PDA. The paramedics were responsible for taking physical and biological measurements (STEPS 2 and 3). The teams were supervised by senior epidemiologists and the National Statistics Institute managers. Data collection lasted two months.

The dependent variable was high cholesterol. The independent variables were exposures to socio-demographic (age, gender, marital status), cultural and economic factors (ethnicity, occupation, income, education, residence (urban/rural)), behavioural factors (tobacco use, harmful alcohol use, low fruit and vegetable (FV) consumption, physical inactivity), clinical factors (obesity, diabetes, high blood pressure (HBP)).

Total cholesterol was measured from a drop of capillary blood taken from the finger with a *Cardiocheck*® measuring device, a threshold ≥ 6.2 mmol/L (≥ 240 mg/dL) was used to define total hypercholesterolemia [15] [16]. Tobacco consumption was relative to the reported amount of tobacco consumed in the 12 months prior to the survey and the mode of consumption (smoked, chewed). Alcohol consumption was quantified in standard glass containing 10 g of ethanol. It was considered harmful if at least 4 standard glasses were taken by women and 6 standard glasses by men per day. It was abusive when it was greater than or equal to 2 standard glasses for women and 4 standard glasses for men per day [15]. The information on FV consumption was obtained from the declarations following the explanations given to the respondents in relation to the self-quantification using portions of fruit and/or vegetables. The portion was defined as a mass of 80 g of fruit and/or vegetables. The interviewers brought with them equivalent bowls to facilitate comparison [2]. Thus, insufficient consumption of FV was defined as consumption of less than five servings of FV per day. Low physical activity (PA) was indicated by a series of questions on the collection tool. Inadequate PA was defined as a low level of PA corresponding to less than 30 consecutive minutes of moderate exercise or equivalent to 20 consecutive minutes of intense exercise for at least 5 days per week [15]. Obesity was defined by a body mass index (BMI) ≥ 30 kg/m^2. Abdominal obesity was defined by a waist cir-

cumference ≥ 80 cm in women and 94 cm in men [17]. A capillary blood glucose test was performed on the participant's finger with *Cardiocheck*®. A conversion factor of 1.1 (plasma to capillary blood glucose ratio) was applied to the random plasma capillary glucose threshold of 11.1 mmol/L [18]. Moderate fasting plasma glucose was defined by fasting plasma glucose ≥ 111 mg/dL and <126 mg/dL and type 2 diabetes by fasting plasma glucose ≥ 126 mg/dL. HBP was defined by systolic blood pressure (SBP) ≥ 140 mmHg and/or diastolic blood pressure (DBP) ≥ 90 mmHg or the presence of medical antihypertensive treatment within 15 days prior to the survey [15].

Data analysis was done according to STEPS recommendations using Epi info7.1.5.0 and SPSS20. The *Chi-square* test was used to compare frequencies and the *Student* test to compare means (if the quantitative variables have a normal distribution). The difference was statistically significant for a *p*-value less than 0.05. Results were presented according to the STROBE recommendations [15].

For ethical and deontological considerations, the protocol was submitted to the National Committee for Ethics in Health Research for ethical advice several months prior to data collection. The free and written informed consent of each participant submitted to the study was obtained as well as the authorization of the local authorities. The personal data of the participants were made anonymous.

3. Results

Out of a sample of 2500 subjects aged 18 to 69 years planned for our study, a total of 2490 (99.6%) were able to participate effectively in STEPS 1, 2, and 3.

3.1. Socio-Demographic Characteristics of Respondents

The survey was conducted with 1499 female subjects versus 991 male subjects, for a sex ratio of 0.66. The mean age was 36.1 ± 12.8 years. The age range most represented was 30 to 44 years (39.3%). Of the various ethnic groups found, Adja and related were the most represented (79.3%). Married people (79%) far exceeded other marital status. The self-employed were the most numerous (76.9%). The majority of respondents (68.2%) lived in rural areas. Subjects with no formal education were in the majority (61.2%). Respondents with an annual income of €313 or more were predominantly represented (49.1%) (Table 1).

Table 1. Distribution of surveyed subjects by socio-demographic characteristics, Mono/Couffo departments in 2015 (N = 2490).

Variables	Frequency	Percentage (%)
Age (years)		
18 - 29	843	33.9
30 - 44	978	39.3
45 - 59	478	19.2
50 - 69	191	7.7

Continued

Sex		
Male	991	39.8
Female	1499	60.2
Ethnicity		
Adja and related	1974	79.3
Fon and related	472	19.0
Baribaand related	4	0.2
Dendiand related	1	0.0
Peulh and related	1	0.0
Yorouba and related	3	0.1
Other	35	1.4
Education		
No official instruction	1525	61.2
Less than elementary school	386	15.5
End of elementary school	301	12.1
End of secondary school level	177	7.1
End of secondary school level	61	2.4
College, University	33	1.3
Post-graduate degree obtained	7	0.3
Marital status		
Never married	316	12.7
Married	1966	79.0
Separated	44	1.8
Divorced	9	0.4
Widows	149	6.0
Cohabitation	6	0.2
Occupation		
Government employee	49	0.2
Employee in the private sector	26	0.1
Self-employed	1914	76.9
Volunteer	44	1.8
Student	165	6.6
Housekeeper	277	11.1
Retired	1	0.0
Unemployed	7	0.3
Disabled person	7	0.3
Setting		
Urban	792	31.8
Rural	1698	68.2

3.2. Overall Prevalence of Hypercholesterolemia in Surveyed Subjects

The mean cholesterol level observed in the population was estimated at 153.20 mg/dL. Of the 2490 subjects surveyed, 116 had hypercholesterolemia, *i.e.* an overall prevalence of 4.70% (95% CI: [3.88 - 5.54]) with 3.4% for men and 5.5% for women ($p = 0.018$).

3.3. Breakdown of Hypercholesterolemia Cases by Department

The prevalence of hypercholesterolemia was three times higher in the Mono (8.5%) than in the Couffo (2.9%). Figure 1 and Table 2 show that the municipalities of Grand-Popo (12.5%) and Comey (8.1%) in the Mono department had more individuals with hypercholesterolemia.

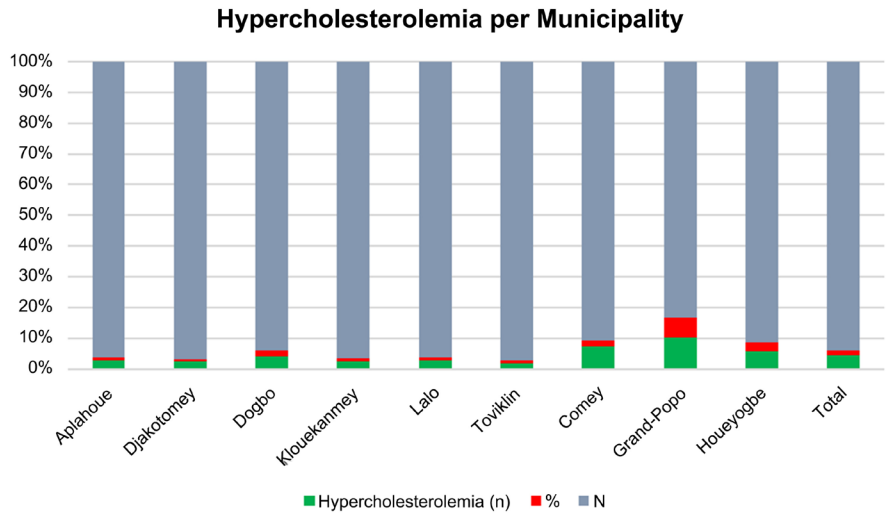

Figure 1. Distribution of hypercholesterolemia cases by municipality of the Mono and Couffo departments, 2015

Table 2. Distribution of hypercholesterolemia cases by Municipalities in the Mono/Couffo departments in 2015.

Municipalities	Hypercholesterolemia (n)	%	N
Couffo Department			
Aplahoue	12	3.0	397
Djakotomey	10	2.6	380
Dogbo	10	4.5	220
Klouekanmey	6	2.5	239
Lalo	8	2.8	280
Toviklin	4	2.0	199
Mono Department			
Comey	32	8.0	397
Grand-Popo	20	12.5	160
Houeyogbe	14	6.4	218
Total	**116**	**4.9**	**2490**

3.4. Factors Associated with Hypercholesterolemia in the Subjects Surveyed

Socio-demographic factors

Hypercholesterolemia was more prevalent in females (5.5%) (p = 0.018) and in the 60 - 69 age group (8.4%) compared to 2.7% in the 18 - 29 age group (p = 0.002). Hypercholesterolemia, which appeared high in certain categories of occupations in particular, the unemployed (14.3%) and volunteers (9.1%) is only apparent (p = 0.094).

Behavioural factors

Hypercholesterolemia was more prevalent among subjects who reported harmful alcohol consumption (15.4%) than their counterparts who did not drink (4.5%), with a statistically significant association with the Fisher Test (p = 0.047). The prevalence of hypercholesterolemia among FV consumers was 5.1% with a statistically significant association (p = 0.028).

Biological/clinical factors

We observed a 6.8% prevalence of hypercholesterolemia in HBP subjects with a statistically significant association (p < 0.001). We found a statistically significant association between overweight, obesity and hypercholesterolemia (p < 0.001).

Multivariate analysis

In multivariate analysis, after adjustment, harmful alcohol consumption (p = 0.023), HBP (p < 0.002), overweight (p < 0.023), obesity (p = 0.043) and type 2 diabetes (p = 0.033) were the factors significantly associated with the presence of hypercholesterolemia. Those who drank harmful amounts of alcohol were 1.5 times more likely to have hypercholesterolemia. Similarly, HBP increased the risk of high cholesterol by 1.12 times. In addition, the risk of developing high cholesterol was increased by 1.89 in overweight subjects. Obesity increased the risk of hypercholesterolemia by 1.66 times. This risk was 2.77 times greater in subjects with type 2 diabetes (Table 3).

Table 3. Associated characteristics of hypercholesterolemia in the Mono and Couffo departments in 2015 (N = 2490). Logistic regression.

	Univariate analysis			Multivariate analysis		
	OR[1]	[IC95%]	p	OR_a[2]	[IC95%]	p
Sex			**0.018**			**0.542**
Male	1.00	Reference		1.00	Reference	
Female	1.59	[1.08 - 2.36]		1.02	[0.80 - 3.08]	
Age			**0.002**			**0.236**
18 - 29	1.00	Reference		1.00	Reference	
30 - 44	1.98	[1.23 - 3.21]		1.02	[0.25 - 2.36]	
45 - 59	1.84	[1.05 - 3.22]		1.15	[0.50 - 3.69]	
60 - 69	3.07	[1.65 - 5.70]		1.80	[0.89 - 3.68]	

Continued

Residence			**0.013**			**0.527**
Urban	1.57	[1.10 - 2.24]		1.08	[0.10 - 2.59]	
Rural	1.00	Reference		1.00	Reference	
Harmful consumption of alcohol			**0.047**			**0.023**
Yes	3.42	[1.61 - 7.32]		1.50	[1.33 - 4.50]	
No	1.00	Reference		1.00	Reference	
FV consumption[3]			**0.028**			**0.211**
Yes	1.00	Reference		1.00	Reference	
No	1.84	[1.00 - 3.41]		2.15	[0.83 - 5.36]	
HBP[4]			**<0.001**			**0.002**
Yes	1.85	[1.29 - 2.65]		1.12	[1.02 - 2.44]	
No	1.00	Reference		1.00	Reference	
Overweight			**<0.001**			**0.023**
Yes	2.52	[1.74 - 3.66]		1.89	[1.21 - 3.12]	
No	1.00	Reference		1.00	Reference	
Obesity			**<0.001**			**0.043**
Yes	2.49	[1.48 - 4.18]		1.66	[1.32 - 3.88]	
No	1.00	Reference		1.00	Reference	
Type 2 diabetes			**<0.001**			**0.033**
Yes	4.44	[2.85 - 6.91]		2.77	[1.89 - 4.59]	
No	1.00	Reference		1.00	Reference	

[1]Odds Ratios; [2]Odds Ratios adjusted; [3]Fruit and Vegetable; [4]High Blood Pressure.

4. Discussion

4.1. Socio-Demographic Characteristics and Living Environment of the Respondents

The Adja and related people, the most represented (79.3%) in the study, constitute the majority ethnic group in the Couffo department. They are predominantly from rural areas (68.2%). The Couffo department tends to have a less modern profile than that of Mono when considering at least the range of occupations in the two departments as mentioned in the study setting, which could explain the lower levels of hypercholesterolemia in the latter department as reported by some authors [8] [19]. The average age of 36.1 ± 12.8 years and the predominance of women who are mostly farmers in this department are characteristics that differentiate them from the populations of the Mono department [12]. The municipalities of Mono with the highest levels of hypercholesterolemia, Grand-Popo (12.5%) and Comey (8.1%), have the characteristics of being the most developed compared to the Couffo department, crossed by an interstate road with the Atlantic Ocean as a southern border and which could be in favor

of such results[5] [8] [20].

4.2. Evolution of Hypercholesterolemia in the Mono and Couffo Departments

When comparing the hypercholesterolemia observed in both departments in 2008 (previous STEPS survey) [12] of 1.2% (Mono) and 1.8% (Couffo) with that obtained by the present STEPS survey (2015), which is 8.5% and 2.9% respectively, an upward trend can be observed in both departments. This progression is slower in the department of Couffo than in the department of Mono for which the characteristics of the two departments in terms of development profile could be an explanatory factor according to several authors [5] [8] [20].

4.3. Sociodemographic Factors and Hypercholesterolemia

Univariate analysis showed a greater hypercholesterolemia in females (5.5%) and less in males (3.4%), in urban (6.2%) than in rural (4.0%) areas with a statistically significant association ($p = 0.018$; $p = 0.013$ respectively). Education level was significantly associated with hypercholesterolemia ($p = 0.029$). These same findings were made in the 2008 STEPS from Benin and 2010 STEPS from Togo, with the difference that both sexes were reached in the same proportions (0.9%) in 2010 [12] [21].

The results of the national nutrition and health study conducted in 2006-2007 in France and published in 2013 showed that 19.6% of adults had hypercholesterolemia. The most affected were the 45/65 year olds (30%) [22]. In Canada, more than 40% of subjects aged 20 to 79 years have a cholesterol level that is harmful to health without any significant gender differences [23]. The prevalence of elevated total cholesterol levels increased with age. It was also higher in urban (6.2%), common-law union (33.3%), separated (9.1%) and widowed (7.4%) individuals, but less so in married, post-graduate and other less educated individuals. This may be indicative of lifestyles with similar risk factors in these groups. In the study by Song *et al.* [20], education was not associated with hypercholesterolemia.

In multivariate analysis in our study, none of these factors were found to be significantly associated with hypercholesterolemia (**Table 3**). A detailed analysis of these factors will provide more precise answers for appropriate actions on the determinants of hypercholesterolemia in this region.

4.4. Behavioural Factors

In univariate analysis, hypercholesterolemia was higher in subjects reporting harmful alcohol consumption (15.4%) and those with low FV consumption (5.1%) with a statistically significant association ($p = 0.047$; $p = 0.028$ respectively). Several other authors reported the same association [9] [24]. We were unable to find a relationship between hypercholesterolemia and physical inactivity or hypercholesterolemia and smoking. In their study, Song *et al.* [20] reported that high

consumption of protein, pork and alcohol was positively associated with hypercholesterolemia, but high consumption of FV was not associated with hypercholesterolemia. In multivariate analysis, FV consumption was also not significantly associated with hypercholesterolemia in our study (**Table 3**).

4.5. Biological/Clinical Factors

Biological/clinical factors significantly associated with hypercholesterolemia in both univariate and multivariate analyses were HBP ($p < 0.001$), overweight ($p < 0.001$), obesity ($p < 0.001$) and type 2 diabetes ($p < 0.001$). These results have been reported by other authors [9] [24]. In their study, Song *et al.* [20] reported a statistically significant association of overweight and obesity with hypercholesterolemia.

4.6. Combination of Several Risk Factors

Multivariate analysis identified a group of mutually reinforcing risk factors for high cholesterol composed of harmful alcohol consumption, HBP, overweight, obesity and type 2 diabetes [19]. These factors seem to be driven by a particular environment [9] [25] as reported by Marmot *et al.* [5] in the study of Japanese people living in Japan, Hawaii and California showing the importance of the living environment on the health of the individual.

4.7. Perspectives

This progression observed in our study compared to the 2008 study [12] would merit an intervention at the risk of seeing the populations of this region under a greater burden of hypercholesterolemia with other NCDs that could be caused by the factors associated with it [9] [26]. Such an intervention must take into account the more important trends observed in different living environments in order to contextualize actions. The experience reported by Kastarinen *et al.* [27] in the provinces of North Karelia and Kuopio (eastern Finland), and the Turku-Loimaa region (southwestern Finland) are examples to be followed and are likely to reduce the progression of hypercholesterolemia observed. A health monitoring strategy taking into account very precise indicators and depending on the context should accompany this intervention in order to know how to adapt to the evolution of the trends that will be observed.

4.8. Study Validity and Limitations

Our study had the advantage of using the national protocol of the NCDs survey combining the results of STEPS 1, 2 and 3 from Benin. As for the external validity of the results, our sampling method following the WHO model in this matter allowed us to have a representative sample of the region studied. However, the results obtained cannot be generalized to all of Benin. As for the internal validity, many of the variables studied were evaluated on the basis of statements made by the respondents and could suffer from measurement bias so that they do not

always reflect the reality. In spite of these limitations, the results we have achieved have made it possible to identify the prevalence of hypercholesterolemia and the factors favoring its appearance in the Mono and Couffo departments in 2015 with the role that the local context should play in the control measures.

5. Conclusion

The burden of hypercholesterolemia increased substantially between 2008 and 2015 in the Mono and Couffo departments with an obvious note of context-dependent. The risk factors most involved were harmful alcohol consumption, high blood pressure, overweight, obesity and type 2 diabetes. The living environment seems to have an impact on the development of these risk factors and the management of this pathological trend of hypercholesterolemia in this region should be able to take this into account for a development that does not harm the health of the population.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Annex 1: Interview Guide

Interviewee's identification number |__|__|__||__|__|__|

	Place and Date	Response	
1	District Code	|__|__|__|	
2	Name of the center/village		
3	Center/village code	|__|__|__|	
4	Consent has been obtained (oral or written)	Yes No	1 2
5	Gender (circle the appropriate number)	Male Female	1 2
6	Quel âge avez-vous?	..... in year	
7	In total, how many years did you spend in school or in full-time training (not including pre-school)?	.....	
8	What is your social and cultural background?	Adja and related Fon and related Bariba and related Dendi and related Yom and related Peulh Otamari Yorouba West African Other African Non-African Refused	1 2 3 4 5 6 7 8 9 10 11 0
9	What is the highest level of education you have achieved?	No official instruction Less than elementary school End of elementary school End of secondary school level End of secondary school level College, University Post-graduate degree obtained Refused	1 2 3 4 5 6 7 0
10	Which of the following categories best describes your main work activity over the past 12 months?	Government employee Employee in the private sector Self-employed Volunteer Student Housekeeper Retired Unemployed Disabled person Refused	1 2 3 4 5 6 7 8 9 0
11	Estimated annual household income	≤€100,00 [101,00 - 200,00] [201,00 - 300,00] [301,00 – 400,00] >€400,00 Don't know Refused	1 2 3 4 5 6 0

Continued

	Tobacco consumption		
12	Do you currently smoke tobacco products such as cigarettes, cigars or pipes?	Yes No	1 2
13	If yes, do you smoke daily?	Yes No	1 2
14	How much of the following do you smoke on average each day?	Industrial Cigarettes Rolled Cigarettes Pipes Cigars, cigarillos Other	|__|__|__| |__|__|__| |__|__|__| |__|__|__| |__|__|__|
15	In the past, have you ever used tobacco daily?	Yes No	1 2
	Alcohol consumption		
16	Have you consumed an alcoholic beverage such as beer, wine, liquor, cider, or local liquor in the past 12 months? If Yes, USE THE CARDS ORSHOW EXAMPLES	Yes No	1 2
17	During the past 12 months, how often did you drink at least one alcoholic beverage?	Daily 5 - 6 days per week 1 - 4 days per week 1 - 3 days per month Less than once per month	1 2 3 4 5
18	When you drink alcohol, how many drinks do you have on average per day?	Number Don't know	|__|__| 0
	Physical activity		
19	Does your job involve high-intensity physical activities that require a substantial increase in breathing or heart rate, such as [heavy lifting, working on a construction site, doing masonry work] for at least 10 minutes at a time?	Yes No	1 2
20	On a typical day during which you perform high-intensity physical activities, how much time do you spend on these activities?	……	
21	Does your job involve moderate intensity physical activity, such as brisk walking or [light lifting] for at least 10 minutes at a time?	Yes No	1 2
22	Do you make trips of at least 10 minutes on foot or by bicycle?	Yes No	1 2
23	Do you participate in any high-intensity sports, fitness, or recreational activities that require a significant increase in breathing or heart rate such as [running or playing soccer] for at least ten minutes at a time?	Yes No	1 2
24	On a typical day, how much time do you spend on it?	……	
	History of diabetes		

Continued

25	Have you had your blood glucose levels tested in the last 12 months?	Yes No	1 2
26	Has a health care provider ever told you that you have diabetes in the last 12 months?	Yes No	1 2
	Physical measurements		
27	Height	**……..m**	
28	Weight	**……..kg**	
	Biochemistry measurements		
29	Fastingblood glucose	…….mmol/L	
30	Total cholesterol	……mmol/L	