CLINICAL RESEARCH

Prevalence of cardiovascular disease in Gabon: A population study

Prévalence des affections cardiovasculaires en population générale au Gabon

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KEYWORDS
Cardiovascular diseases; Africa; Epidemiology; Hypertension

Summary
Background. — Data supporting epidemiological transition from a predominant burden of infectious diseases to one of chronic diseases in Africa result mostly from hospital surveys.
Aim. — To estimate the cardiovascular disease (CVD) burden in Gabon.
Methods. — The study was conducted in Ntoum (8765 inhabitants). All subjects aged greater or equal to 40 years were invited to participate. Participants were interviewed about CVD history and risk factors; they responded to questionnaires on claudication and angina and had a clinical examination, including lower limb pulse palpation and bilateral brachial pressure measurement. Subjects were considered to have CVD in case of history of CVD

Abbreviations: BMI, body mass index; CAD, coronary artery disease; CI, confidence interval; CVD, cardiovascular disease; DM, diabetes mellitus; ECQ, Edinburgh Claudication Questionnaire; HR, hazard ratio; PAD, peripheral artery disease; WHO, World Health Organization.
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Background

For a very long period, cardiovascular diseases (CVD) were considered as negligible in African countries, especially compared with other public health issues. Recent data demonstrated an epidemiological transition from a predominant burden of infectious diseases to one with chronic diseases, particularly CVD related to atherosclerosis. The rate of CVD mortality is increasing in regions of sub-Saharan African [1–3]. Nowadays, cardiovascular deaths are by far more frequent in developing countries than in developed countries [4]. This situation might result from a complex combination of population, lifestyle and genetic characteristics. Increased life expectancy is also usually associated with an increased burden of degenerative disorders.

In sub-Saharan Africa, most data result from hospital surveys. The INTERHEART study in Africa [5] demonstrated identical relationships between common risk factors and acute myocardial infarction in African populations and the global population. There is growing evidence of increasing rates of CVD mortality in African countries [2,3], although the rates are still lower than in more developed countries.

Conversely, few population-driven studies are conducted in Africa. Most population surveys were conducted in South Africa [6–8]: the prevalence of CVD risk factors in the rural community of Limpopo was reported as high, close to the prevalence described in the western population [6]. The prevalence of hypertension in sub-Saharan African populations was generally low, but major changes have occurred recently, with an increasing incidence not only in urban populations but also extending into rural populations [9]. The prevalence of stroke was documented as being up to 300/100,000 inhabitants of the Agincourt area in South Africa [7]. Data from Soweto supported the emergence of ischaemic heart disease in the urban population [8]. Peripheral artery disease (PAD) prevalence rates were estimated at 29.3% in the Cape Town population aged greater than 50

 Español

MOTS CLÉS
Afectaciones cardiovasculares; África; Epidemiología; Hipertensión arterial

Resumen

But. — El objetivo de esta estudio es de precisar la prevalencia de las afecciones cardiovasculares sintomáticas y asintomáticas en población general de Gabón.

Métodos. — La encuesta, efectuada en la región de Ntoum (8765 habitantes), a incluido a todos los sujetos superiores o iguales a 40 años; ella comportaba la búsqueda de antecedentes y factores de riesgo cardiovascular, la administración de cuestionarios para el lenguaje y la claudicación, un examen clínico con una presión arterial a los dos brazos y cálculo de la presión del músculo de las manos inferiores. Los sujetos se han considerado como presentando una afección cardiovascular en caso de antecedente de coronariopatía, cérurbovascular, de arteriopatía de las manos inferiores, y un examen general positivo o en estado de alerta durante el examen clínico.

Resultados. — La población estaba de 736 sujetos (313 hombres, 423 mujeres). La prevalencia de la hipertensión arterial está elevada (entre 50 a 60 años), 47,7% por el hombre y 53,7% para las mujeres. Algunos de los 382 pacientes hipertensos, 74 (19,4%) eran tratados y 22 (5,8%) controlados. La prevalencia de una afección cardiovascular y 13,6% (98 sujetos); para los hombres y las mujeres, ella se elevó respectivamente a 14,7% y 11,5%, y en 8,9% de las mujeres. La hipertensión se incrementa el riesgo general (HR 3,69, IC 95% 2,11–6,16; p < 0,001), pero que el accidente vascular cerebral (HR 4,57, IC 95% 1,26–16,50; p < 0,05), de arteriopatía de los miembros (HR 2,03, IC 95% 1,03–4,00; p < 0,05) y subclaviano arteria estenosis (HR 5,79, IC 95% 2,21–15,2; p < 0,05).

Conclusión. — Las tasas de enfermedades cardiovasculares pueden ser un importante problema de salud pública en este país.

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years and more than 25% in the Agincourt population aged greater than 60 years. Data regarding the burden of CVD and CVD risk factors in other African countries are scarce. Most of these countries have limited resources and primary prevention is consequently of outmost importance. Therefore, knowledge about the epidemiology of CVD and the use of simple methods to detect subclinical CVD are useful for appropriate preventive strategies.

The aim of this study was to identify the prevalence of CVD and associated risk factors in Gabon, a sub-Saharan country on the east coast of Africa.

**Methods**

**Data collection and definition**

The study is ancillary to a survey regarding the prevalence of epilepsy [10] in the community of Ntoum, Gabon. Ntoum is a city with 8765 inhabitants, in the administrative region of the estuary, located in northeast Gabon. The population is mainly rural but also includes business and industry workers. Overall, 6259 subjects were included in the first survey and 736 in the ancillary study; subjects aged greater or equal to 40 years were included in the ancillary study. In the last census, subjects aged more than 40 years represented 14% of the Gabonese population [11].

Over a period of 12 days, a group of 46 field investigators visited all of the households in the area. A group of 10 guides accompanied the investigators. Each day, the investigators visited a district that had been previously determined; all of the residents had already been informed about the study. The investigators were trained by one of the authors (EN). All subjects aged more than 40 years were also asked to participate in the CVD survey; all participants gave their informed consent. Subjects were interviewed about their smoking status (non-smokers or ever smokers, including former or current smokers) and history of diabetes mellitus (DM), hypertension and dyslipidaemia. Health records and prescriptions were analysed. Participants reporting DM were asked about their use of insulin and oral medications. Participants reporting DM were asked about their history of documented stroke, heart or vascular disorders. Height and weight were measured with the participants being barefoot and wearing light clothing. Body mass index (BMI) was calculated as kg/m². A waist measurement was performed using a non-stretching tape with the subject in the standing position. Blood pressure was measured on both arms with a mercury manometer. Hypertension was defined either as the use of antihypertensive drugs or as resting arm systolic blood pressure greater or equal to 160 mmHg (participant sitting for 5 minutes). Lower limb peripheral pulses (posterior tibial and dorsalis pedis) were palpated in the same position. As the population is French speaking, French versions of the World Health Organization (WHO) Rose angina questionnaire and the Edinburgh Claudication questionnaire (ECQ) for intermittent claudication were used [12,13].

Coronary artery disease (CAD) was defined as a history of CAD reported by the participant or a positive WHO Rose angina questionnaire. Cerebrovascular disease was defined as a report of a documented stroke or transient ischaemic attack. PAD was defined as a documented history of PAD, an absent posterior tibial pulse or a ‘positive’ or ‘possible’ ECQ (‘possible’ being defined as calf pain on walking but otherwise not fully concordant with the ECQ criteria [14]. Finally, an interarm systolic blood pressure difference greater than 15 mmHg defined the presence of subclavian stenosis, a condition recently found to be a marker of poorer CVD prognosis [15]. The participants were considered as having CVD in case of any of the above-mentioned situations. In the absence of a specific ethical committee in this country, the survey was approved by the Ministry of Public Health and of Gabon.

**Statistical methods**

Data are reported as mean ± standard deviation. Categorical data are presented as percentages with 95% confidence intervals (CIs) when appropriate. Comparisons within groups were made using the Chi² test for categorical variables and Student’s t test for continuous variables. To assess the association between CVD and the risk factors, a multiple logistic regression analysis was used to determine the independent predictive factors, using a backward stepwise method. A P value < 0.05 was fixed for statistical significance. Statistical analyses were performed using Statview 5.0 software (SAS Institute, Cary, NC, USA).

**Results**

A total of 736 subjects (313 men; 423 women) were included in this survey. Table 1 presents the main characteristics of the population. Smoking was more prevalent among men, while BMI was higher in women. Hypertension was highly prevalent: up to 47.7% and 53.7% in men and women aged 50 to 60 years, respectively (Fig. 1). Among the 382 participants with hypertension, 74 (19.4%) were treated and only 22 (5.8%) had controlled blood pressure.

Among the 736 participants, 98 (13.3%) were identified as having a CVD. The prevalences of overall and newly diagnosed CVD were 14.7% and 11.5% for men and 14.9% and 8.9% for women, respectively (Fig. 2). The distribution of different abnormal conditions is presented in Table 2. CVD prevalences according sex and age are displayed in Fig. 3. Hypertension was more prevalent in the case of CVD and BMI was slightly lower (Table 3). The other risk factors were equally distributed. The association between CVD and CVD risk factors is presented in Table 4. Hypertension was associated with a 3.69-fold increased risk of CVD. Considering the different localizations of CVD, the hypertension hazard ratio (HR) was 2.03 (95% CI 1.03—4.00; P < 0.05) for abnormal tibial posterior pulse palpation (i.e. PAD), 5.79 (95% CI 2.21—15.2; P < 0.05) for subclavian stenosis and 4.57 (95% CI 1.26—16.50; P < 0.05) for cerebrovascular disease; the relationship between hypertension and a positive WHO Rose angina questionnaire was close to significance (HR 2.32, 95% CI 0.93—5.79). Being male also conferred an increased risk of PAD (HR 2.34, 95% CI 1.13—4.83; P < 0.05).
Table 1  General characteristics of the study population.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Overall (n = 736)</th>
<th>Men (n = 313)</th>
<th>Women (n = 423)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agea (years)</td>
<td>57.0 ± 11.6</td>
<td>57.2 ± 11.4</td>
<td>56.8 ± 11.8</td>
<td>0.64</td>
</tr>
<tr>
<td>Smoker</td>
<td>254 (34.5)</td>
<td>123 (39.3)</td>
<td>131 (31.0)</td>
<td>0.03</td>
</tr>
<tr>
<td>Dyslipidaemia</td>
<td>14 (1.9)</td>
<td>6 (1.9)</td>
<td>8 (1.9)</td>
<td>0.99</td>
</tr>
<tr>
<td>Diabetes</td>
<td>12 (1.6)</td>
<td>8 (2.6)</td>
<td>4 (1.0)</td>
<td>0.14</td>
</tr>
<tr>
<td>Hypertension</td>
<td>382 (51.9)</td>
<td>166 (53.0)</td>
<td>216 (51.1)</td>
<td>0.61</td>
</tr>
<tr>
<td>Treated hypertension</td>
<td>74 (10.5)</td>
<td>27 (8.6)</td>
<td>47 (11.1)</td>
<td>0.32</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>28.1 ± 7.9</td>
<td>27.2 ± 6.6</td>
<td>28.7 ± 8.6</td>
<td>0.02</td>
</tr>
</tbody>
</table>

Data are mean ± standard deviation or number (%).

* Calculated for only 681 participants of known age.

Figure 1.  Overall and known prevalences of hypertension (HTN) by sex and age.

Figure 2.  Known and unknown cardiovascular disease (CVD) by sex and age in Ntoum, Gabon.
Table 2  Clinical findings: symptomatic and asymptomatic cardiovascular disease.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>History of myocardial infarction</td>
<td>16 (2.2)</td>
</tr>
<tr>
<td>History of stroke</td>
<td>16 (2.2)</td>
</tr>
<tr>
<td>Positive WHO Rose angina questionnaire</td>
<td>14 (1.9)</td>
</tr>
<tr>
<td>ECQ—definite</td>
<td>0 (0)</td>
</tr>
<tr>
<td>ECQ—possiblea</td>
<td>19 (2.7)</td>
</tr>
<tr>
<td>At least one limb with absent distal pulses</td>
<td>25 (3.4)</td>
</tr>
<tr>
<td>Subclavian stenosis</td>
<td>38 (5.1)</td>
</tr>
</tbody>
</table>

a Possible Edinburgh claudication questionnaire (ECQ) defined as exercise calf pain not present at rest but otherwise not fully concordant with the ECQ criteria. WHO: World Health Organization.

Discussion

In this survey, we documented a high prevalence of CVD in the Gabonese community. Over the age of 40 years, more than 13% of the population presented symptomatic or asymptomatic CVD. In previous studies [15–17], all of the clinical and subclinical conditions detected in this study were associated with a high risk of cardiovascular events during follow-up. Our data are in accordance with other data supporting an epidemiological transition in Africa, with elevated rates of chronic conditions, particularly CVDs, in sub-Saharan countries.

In the Southern African Stroke Prevention Initiative (SAPSI) study, Fowkes et al. [18] reported a prevalence of PAD defined by a low ankle-brachial index (<0.9) of 3.9%, 11% and 25.5% in the age groups of 40 to 49, 50 to 59 and 60 to 69 years, respectively; the distribution was very similar to that found in western populations. It is important to notice that in our study, 11.5% of men and 8.9% of women presented an unknown CVD. Data screening programmes might therefore be useful.

Given the paucity of healthcare resources in developing countries, it is of critical concern to develop simple,

![Figure 3](image_url)  

Figure 3. Prevalences of coronary artery disease (CAD), cerebrovascular disease (CBVD), peripheral arterial disease (PAD) and subclavian stenosis (SS) by sex and age.

Table 3  Risk factors for any cardiovascular disease: univariate analysis.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Subjects with CVD(n=98)</th>
<th>Subjects without CVD (n=583)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>59.4 ± 12.8</td>
<td>56.6 ± 11.3</td>
<td>0.03</td>
</tr>
<tr>
<td>Male</td>
<td>45 (45.9)</td>
<td>257 (44.1)</td>
<td>0.75</td>
</tr>
<tr>
<td>Smoker</td>
<td>38 (38.8)</td>
<td>196 (33.6)</td>
<td>0.49</td>
</tr>
<tr>
<td>Treated dyslipidaemia</td>
<td>3 (3.1)</td>
<td>10 (1.7)</td>
<td>0.41</td>
</tr>
<tr>
<td>Treated diabetes</td>
<td>2 (2.0)</td>
<td>10 (1.7)</td>
<td>0.69</td>
</tr>
<tr>
<td>Hypertension</td>
<td>73 (74.5)</td>
<td>277 (47.5)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>27.2 ± 8.9</td>
<td>28.4 ± 7.6</td>
<td>0.17</td>
</tr>
</tbody>
</table>

Data are mean ± standard deviation or number (%). CVD: cardiovascular disease.
low-cost tools for detecting subjects at high risk of CVD in these populations. In this context, screening for subclavian stenosis could be a useful strategy. The prevalence of subclavian stenosis was 5.1% in our study. Subclavian stenosis defined similarly to this study (interarm systolic blood pressure difference greater than 15 mmHg) was found in 1.9% of a community-dwelling population in the USA and in 7.1% of outpatients visiting a vascular laboratory [19].

In another study [20], the traditional CVD risk factors were closely associated with subclavian stenosis; the prevalence was 1.7% in subjects without CVD risk factors but increased to 4.3% in case of smoking or hypertension and 6.8% in case of diabetes. The predictive value of subclavian stenosis was documented in a multicohort study that included 1778 participants [15]; among them, 8.8% presented an subclavian stenosis as defined above. During a mean follow-up of 9.8 years, this condition was associated with an increased risk of CVD (HR 1.57; P < 0.05) and total mortality (HR 1.40; P < 0.01). While the prognostic value of subclavian stenosis in African people has not yet been assessed, it is plausible that subclavian stenosis could be helpful for the clinical estimation of individual cardiovascular risk. In line with this, a multiethnic cohort in the USA, including participants of African descent, found a positive association between subclavian stenosis and coronary artery calcium score [21].

High blood pressure was highly prevalent, with more than 50% of these semiurban dwellers presenting with systolic blood pressure greater than 160 mmHg. Such a high prevalence of hypertension has been described previously, with differences between rural and urban communities; the levels of hypertension were 15.4% in a rural community in Cameroon, 50% in an urban community in Ghana [9,22] and 43% in a community in South Africa [23]. In our study, hypertension was closely related to an increased risk of CVD and, in particular, with a 5.7-fold increased risk of subclavian stenosis. As the risk of CVD is related to blood pressure, this situation might lead to an increased risk of stroke, kidney disease or heart failure. In addition, in the INTER-HEART study [5], the risk of myocardial infarction related to hypertension was higher in the black African group than in the overall group. The situation in the Gabonese community is very similar to that described by Addo et al. in sub-Saharan Africa [24], who reported that less than 40% of hypertensive subjects were detected, less than 30% of those diagnosed with hypertension were receiving treatment and less than 20% were actually controlled. These data confirm the urgent need for preventive strategies in these countries.

**Limitations**

There are a few limitations to our study. First, women were over-represented, so sick men might be over-represented as a result of healthy men working far from the home. However, over the age of 65 years, the Gabonese population demonstrates a female predominance, with a male:female ratio of 0.72 [25]. Except for hypertension, risk factor collection was declarative, so we probably underestimated the real burden of diabetes and dyslipidaemia. All the data were confirmed with prescriptions, health records and hospital chart analysis. The response rates for tobacco smoking were low, partly explained by the different types of smoking (e.g., pipe) and less smoking of manufactured cigarettes. In the Limpopo study [6], women used mainly smokeless tobacco (snuff and chewing); we did not document this sort of practice. The definition of high blood pressure as a systolic measurement greater than 160 mmHg may overestimate the links between hypertension and CVD; conversely, the relationship might be underestimated for other risk factors, particularly DM, as their definitions were declarative, resulting in a low prevalence. A further limitation is that no subject described a positive ECQ, even with a validated translated version of the questionnaire. The representation of pain when walking might be different in this population. The Gabonese population is French speaking with quite a good educational level: greater than 60% of the population aged greater or equal to 15 years can read and write [25], and the questionnaires were administered by local investigators. Yet our findings should be considered as conservative and it is possible that the burden of CVD in this sub-Saharan country is underestimated in our study. Further surveys studying the relationship between subclinical CVD and ultrasound methods in African community are awaited.

**Conclusion**

Our findings confirm the high prevalence of clinical and subclinical CVD in a sub-Saharan community. They also confirm the increasing burden of hypertension. Taken together, these data support the ongoing epidemiological transition. In the future, cardiovascular prevention measures should be implemented in these countries.

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Table 4  Risk factors for any cardiovascular disease: multivariable analysis.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Initial model</th>
<th>P</th>
<th>Final</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1.01 (0.98–1.03)</td>
<td>0.54</td>
<td>3.69 (2.21–6.16)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Male</td>
<td>1.05 (0.66–1.65)</td>
<td>0.82</td>
<td>0.97 (0.94–1.00)</td>
<td>0.049</td>
</tr>
<tr>
<td>Smoker</td>
<td>1.09 (0.67–1.77)</td>
<td>0.72</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treated dyslipidaemia</td>
<td>1.98 (0.48–8.23)</td>
<td>0.35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treated diabetes</td>
<td>1.01 (0.19–5.30)</td>
<td>0.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hypertension</td>
<td>3.55 (2.11–5.97)</td>
<td>&lt; 0.0001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Body mass index</td>
<td>0.97 (0.94–1.00)</td>
<td>0.06</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data are hazard ratio (95% confidence interval).
Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

References


