Journal of Diabetes Mellitus, 2015, 5, 135-140
Published Online August 2015 in SciRes. http://www.scirp.org/journal/jdm
http://dx.doi.org/10.4236/jdm.2015.53016

Prevalence and Risk Factors of Diabetes Mellitus in the Adult Population of Porto-Novo (Benin)

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Received 4 May 2015; accepted 30 June 2015; published 3 July 2015

Abstract

Introduction: The aim of this study was to determine the prevalence and risk factors of diabetes mellitus in the adult population of Porto-Novo. Methods: A cross-sectional study with random sampling, stratified cluster, was used. Fasting blood glucose was measured in capillary blood (Accu-Chek Active). Diabetes mellitus was defined as fasting glucose ≥ 1.26 g/L, and fasting hyperglycemia in non-diabetic fasting glucose ≥ 1.10 and < 1.26 g/L. Results: The survey involved 240 individuals. The sex ratio was 0.48. The mean age was 46 ± 13 years (range 25 - 80 years). The prevalence of hyperglycemic patients was 7.9%. The prevalence of diabetes was 6.7%, including 3.3% of unknown diabetes, half of diabetics. The prevalence of fasting hyperglycemia without diabetes was 1.2%. The risk factors for diabetes type 2 onset were a family history of diabetes (p = 0.017), older age (p = 0.003), hypertension (p = 0.005) and abdominal obesity (NCEP: p = 0.044; FID: p = 0.001). Conclusion: These high figures confirm the increasing prevalence of diabetes mellitus in Benin, documented in many developing countries.

Keywords

Diabetes Prevalence, Risk Factors, Porto-Novo, Benin

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How to cite this paper: Amoussou-Guenou, D., Wanvoegbe, A., Hermans, M., Agbodande, A., Boko, M., Fandi, A.A.-G. and Kerekou, A. (2015) Prevalence and Risk Factors of Diabetes Mellitus in the Adult Population of Porto-Novo (Benin). *Journal of Diabetes Mellitus*, **5**, 135-140. http://dx.doi.org/10.4236/jdm.2015.53016

1. Introduction

Diabetes mellitus is one of the most common and worldwide non-communicable diseases [1] [2]. It is a major global public health issue because of its increasing frequency, morbidity, mortality, and its socio-economic cost [3].

The World Health Organization (WHO) estimated in 1995 that the prevalence of diabetes mellitus was about 135 million of adults worldwide [4]. This figure has increased significantly in recent decades, so that diabetes mellitus currently affects 381,800,000 people worldwide (estimates of the International Diabetes Federation (IDF) 2013) [5]. IDF anticipates the increasing of this number to 591.9 million for 2035, an increase of 55.0% [5]. This increase in number of diabetics is proportionately greater in developing countries, and will be more in Africa, where the number of diabetics is expected to increase, according to estimates of IDF, from 19.8 million in 2013 to 41,400,000 in 2035 [5]. Although the prevalence and progression of diabetes mellitus are well documented in industrialized countries, this is not the case in developing countries due to a lack of recent epidemiological, reliable and representative data [6], particularly in sub-Saharan Africa. [7]

In Benin, several prevalence surveys were conducted in the past. Thus, the frequency of diabetes mellitus was:

- 1.1% in 2001 [8], then measured at 2.6% in 2007 at the national level [9];
- 3.3% in Cotonou in 2002 [8], then measured at 4.6% in 2007 [10];
- 0.9% in Oueme Department in 2007 [9].

Since 2007, to our knowledge, there have been no reports of diabetes mellitus prevalence in Porto-Novo, capital of the Republic of Benin. The present work was therefore designed to determine the prevalence and risk factors of diabetes mellitus type 2 in the urban adult population of Porto-Novo.

2. Subjects and Methods

The study was cross-sectional, descriptive and analytical, and was conducted according to the "STEP wise" approach recommended by WHO for the screening and monitoring of risk factors of non-communicable diseases [11]. It took place from June 1 to July 28, 2014. The target population consisted of adults of the five townships of Porto-Novo. Were included in the study, subjects aged 25 - 80 years, of both sexes, residing in Porto-Novo, and having given their consent. Fasting blood glucose was measured in capillary blood using a validated glucometer Accu-Chek Active. The diagnosis of diabetes mellitus was made on the basis of a recognized diabetes status and/or a fasting glucose > or = 1.26 g/L (7 mmol/L).

Fasting hyperglycemia without diabetes (HJND) was defined with any person not known as diabetes based on fasting glucose and > or = 1.10 and < 1.26 g/L. The collected data were analyzed with the EPI INFO version 3.5.3 software. For comparisons between data, a value of $p < 0.05$ was considered statistically significant.

3. Results

3.1. General Characteristics of the Population

The minimum number of participants to include, calculated by the Schwartz formula, was 211. This figure was increased by 10% to account for non-responders, resulting in a sampling size of 232 subjects, rounded 240 subjects included in the study.

The mean age of patients was 46.07 ± 12.63 years, with a range from 25 to 80 years. The age group 35 - 45 was the most represented. Women were the majority (162 against 78 men), respectively 67.5% against 32.5% (sex ratio 0.48).

3.2. Prevalence of Impaired Glucose Homeostasis

The overall prevalence of hyperglycemia (diabetes mellitus and HJND) was 7.9%; that of 1.2% HJND; and that diabetes mellitus was 6.7%. Of the 16 patients with diabetes mellitus, 8 new cases were detected by the survey, representing 50% of all cases of diabetes mellitus, corresponding to a prevalence of unrecognized diabetes of 3.3% (**Table 1**).

3.3. Diabetes Risk Factors (Table 2)

3.3.1. Sex

The prevalence of diabetes mellitus was 6.4% for men against 6.8% in women ($p = 0.91$), suggesting that the sex

Table 1. Subjects distribution according to the glycaemic profile.

Fasting glucose	Number	Percentage
Normal	221	92.1
Non-diabeticfasting hyperglycaemia	3	1.2
Diabetes mellitus	16	6.7
Total	240	100

Table 2. Summary of sought risk factors.

	Diabetes prevalence (%)			p
Sex				
M	6.4			
F	6.8			0.912
Age				
[25 - 35]	0.0			
[35 - 45]	5.7			
[45 - 55]	3.7			
[55 - 65]	12.8			
≥65	21.7			0.003
HBP				
yes	11.3			
No	2.4			0.005
Abdominal obesity				
FID	*Yes* 10.8	*No*	0.0	0.001
NCEP	*Yes* 10.3	*No*	3.8	0.044
Family history of diabetes				
yes	14.0			
No	4.7			0.017

was not associated with an increased prevalence of diabetes (Table 2).

3.3.2. Year Old

The prevalence of diabetes increased with age of the subjects studied, with a peak of 21.7% among those aged ³65 years (p = 0.003%).

3.3.3. High Blood Pressure

The prevalence of diabetes mellitus in hypertensive patients was 11.3% against 2.4% among non-hypertensive, with a statistically significant difference (p = 0.005).

3.3.4. Abdominal Obesity

The prevalence of diabetes mellitus in subjects with abdominal obesity according to IDF criteria was 10.8% against 0.0% in patients with no abdominal obesity (p = 0.001). According to the criteria of the National Cholesterol Education Program (NCEP), it was 10.3% in obese, against 3.8% in non-obese (p = 0.044)

3.3.5. Family History of Diabetes

The prevalence of diabetes mellitus in patients with a family history of diabetes mellitus (1 generational distance) was 14.0%, against 4.7% in patients with no family history of diabetes mellitus (p = 0.017).

4. Discussion

4.1. Population Characteristics

The mean age of the study populations differed significantly between the prevalence studies available. Thus, the average age of patients in our study was 46.07 years, relatively close to those reported by Djrolo *et al.* (39.4

years in Cotonou (Benin) in 2007) [10], for Balde *et al.* (49.4 years in 2007 to Labe (Guinea)) [12], for Mbaye *et al.* (43.4 years in 2011 in Saint-Louis (Senegal)) [13], and Oulad *et al.* (52 years in 2009 in Marrakech (Morocco)) [14].

Age over 40 years is an occurrence known risk factor for type 2 diabetes [15]. Ages of ³65 years and 55 - 64 were the most affected by diabetes. Our results are in line with those reported by Mbaye *et al.* St. Louis (Senegal) [13], where, in urban areas, ages 50 - 59 years and 60 - 69 years were the most represented.

In our survey, female was predominantly represented 67.5% of the sampled subjects and a sex ratio of 0.48. This reflects the female population in Benin.

4.2. Prevalence

4.2.1. Hyperglycemia in Non-Diabetic Fasting

The prevalence of HJND was 1.2% in our study population, similar to that reported for Ouémé (1.2%) in STEPS survey [9], but lower than that reported by Djrolo *et al*. (3.5%) in Cotonou in 2007 [10] and Balde *et al.* (13.4%) in Labe (Guinea) in 2007 [12]. It is also lower than that of Wang *et al.* (3.3%) in China in 2009 [16] and Fagot *et al.* (5.6%) in France in 2006 [17].

4.2.2. Diabetes

The prevalence of diabetes mellitus (known and unknown) was high in our study (6.7%). It corresponds to the upper margin estimates for the urban black Africa, ranging from 2 to 6% [18], signifying that the prevalence of diabetes mellitus is clearly increasing in Porto-Novo, like many other cities of the world. In Benin, at the end of STEPS survey in the general population, Djrolo *et al.* [9] in 2007 reported a prevalence of 0.9% in the department of Ouémé, and 2.6% nationally. This prevalence of 6.7% is close by against those reported by Balde *et al.* (6.1%) in 2007 in Labe (Guinea) [12]; by Belhadj *et al.* (7.3%) in 2010 in Algeria [19]; and that reported in Canada (7%) in 2011 [20]. It is against superior to those reported by Lokrou *et al.* (1.33%) in Abidjan (Ivory Coast) in 2000 [21]; by Djrolo *et al.* (4.6%) in 2007 in Cotonou (Benin) [10]; Wang *et al.* (5.5%) in 2009 in China [16]; and that reported in Seine-Saint Denis (France) to 5.8% in 2006 [17]. This is certainly due to the aging of these studies at a time when the prevalence of the disease was lower than current rates.

The growing trend documented by this work is part of the global evolution of progression of diabetes mellitus [3] [22], usually attributed to a combination of changes in lifestyle (reduced physical activity) and changes in eating habits (safety and excess calories, fat intake increased, especially saturated fat, high glycemic index, rapidly absorbed sugars), favored by industrialization and urbanization.

However, the prevalence we found remains lower than that reported by Oulad *et al.* (10%) to Marrakech (Morocco) [14] and Mbaye *et al.* (10.4%) in 2011 in Saint-Louis (Senegal) [13]. These differences are probably related to ethnic regional differences; food; socio-cultural; and cardio-metabolic groups studied.

In our study, the prevalence of unrecognized diabetes was 3.3%, about half of people with diabetes mellitus. This high prevalence of unrecognized diabetes is similar to that reported by Djrolo *et al.* (3.4%) in 2007 in Cotonou [10] but exceeds that reported by Mbaye *et al.* (2.6%) in 2011 in Saint-Louis (Senegal) [13]. This high rate justifies a proactive policy of screening for this population at risk of vascular complications in the long term, due to the lack of support for chronic hyperglycemia.

4.3. The Risk Factors for Diabetes Mellitus

An association between diabetes mellitus and age was highlighted in the statement ($p = 0.003$). This is consistent with the observation that the incidence of diabetes mellitus increases with age especially after 40 years. We do not, for contrary, observe statistically significant differences in the prevalence of diabetes mellitus gender ($p = 0.91$). Sex does not appear as a risk factor of diabetes mellitus in our study, and the relative prevalence of diabetes was almost equal between the sexes (6.4% for men against 6.8% for women). This finding is similar to that reported by Djrolo *et al.* (4.7% versus 4.5%) in Cotonou in 2007 [10], for Balde *et al.* (6.2% versus 6.1%) in Labe (Guinea) in 2007 [12] and by Mbaye *et al.* (10.2% versus 10.5%) in Saint-Louis (Senegal) in 2011 [13]. Prevalence in male was reported in France in 2010 (6.4% against 4.5%) [23] and Madagascar in 2005 [24]. On the other hand, Algeria [25] and Niger [26], the surveys were found higher in women.

In our study, the difference in the prevalence of diabetes mellitus in hypertensive and non-hypertensive patients was statistically significant ($p = 0.005$). High blood pressure (hypertension) is a cardio-metabolic factor

usually associated with the common form of type 2 diabetes, insulin resistance, central obesity and metabolic syndrome. This is consistent with the majority of the literature data. Indeed, Mbaye in Senegal [13], Dembele in Mali [27], Lokrou in Ivory Coast [21], Akintewe in Nigeria [28], Balde in Guinea [12] and Wang in China [16] reported an association between frequent diabetes mellitus and hypertension.

The prevalence of diabetes mellitus in subjects with abdominal obesity was 10.3% (NCEP criteria) and 10.8% (IDF criteria). These rates are lower than those reported by Mbaye *et al.* St. Louis (Senegal) 52.0% (NCEP) and 73.6% (IDF) [13]. The prevalence of diabetes mellitus was against by only 3.8% (NCEP) and zero (FID) in subjects with no excess weight. Whatever the criteria used, an association between diabetes mellitus and abdominal obesity was highlighted (NCEP: $p = 0.044$; FID: $p = 0.001$), confirming that abdominal obesity is a major risk factor for diabetes mellitus type 2. This finding is similar to that of Mbaye *et al.* in Senegal in 2011 [13].

Many opinions demonstrate a strong association between parental heredity and the onset of type 2 diabetes [13], due to a transmission traits predisposing to insulin resistance; obesity; and/or the accelerated loss of insulin secretory function β. Our results in this direction, showing a statistical association between family history of diabetes and the prevalence of diabetes mellitus ($p = 0.017$). And family history of diabetes mellitus was a risk factor of diabetes mellitus in Wang's report in China [16] and in Mbaye's in Senegal [13].

5. Conclusion

This study documented a high prevalence of diabetes mellitus (6.7%) in an urban adult population of Porto-Novo in Benin, confirming the alarming increase in prevalence of the disease; half of the cases were unknown. These data confirm the literature data showing that diabetes mellitus is growing rapidly in developing countries; the urban environment is a highly diabetogenic environment.

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