

Prevalence of Diabetes among Obese People in Bénin: Case of the Cities of Bohicon and Abomey

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Abstract

Obesity is rising sharply in most industrialized countries as well in developing areas and this increase was parallel to that of diabetes mellitus. Both physiopathologic ties diseases are real health problems. This adds to a psychological impact which caused an economic and social cost of primary importance. The present work, firstly aims at evaluating the prevalence of diabetes mellitus in obese persons and secondly at looking for other risk factors for diabetes in obese people. 130 people (20 men and 110 women) were sampled in the cities of Bohicon and Abomey in Bénin. The variables studied were: age, gender, anthropometric variables (height, weight, body mass index, waist circumference, capillary and blood glucose), biochemical variables (plasma glucose, total cholesterol, high density lipid –HDL-, low density lipoprotein –LDL-). The prevalence of diabetes in the obese people taken into account was 15.38%, the rate was seven times higher than that found in non-obese. Even if this rate is higher than that of non-obese population, it shows that not all diabetics are obese. We were not able to assess the impact of heredity and dyslipemia on the development of diabetes in obese people. To conclude, obesity is not directly linked to the origin of the diabetic condition, but it triggers diabetes more than it causes it.

Keywords: Diabetes, obesity, physiopathology, prevalence

1. Introduction

Public opinion often wrongly or rightly considers that any obese person is predisposed to diabetes mellitus [1]. Diabetes and obesity are physiopathologic ties diseases which are a real public health problem because of their frequency, social cost and complications [2, 3].

Someone is said diabetic if his blood-sugar level is equal to 1.26 g/l on an empty stomach [4]. Diabetes mellitus is part of a group of metabolic diseases characterized by chronic hyperglycemia accompanied by a disorder of the metabolism of carbohydrates, lipids and proteins due to insufficient secretion or deficiency of insulin action or both [5, 6]. According to estimations of the World Health Organization (WHO), in 2025 the number of diabetics will increase by 170% in developing countries vs 41% in developed countries [7]. Aside from arterial hypertension, obesity is the main cardiovascular risk factor associated with diabetes [8].

In many cultural areas, particularly in Africa, stoutness is seen as a sign of wealth. In addition, luscious or a bit overweight African women have a reputation of being

more attractive while it has been established that obesity is a risk factor for the appearance of chronic non-communicable diseases [9]. In addition, obesity in women represents even in developing countries an obstetrical risk factor leading to high frequency of complications during pregnancy and needs the development of preventing actions [10, 11]. Obesity is the accumulation of excess fat tissue in the body under the skin and viscera.

In addition, the percentage of body fat increases with age up to 60-65 years old in both sexes and is more important with women than men for the same body mass index [12]. It is said that a person is obese if his body mass index (BMI) is greater than or equal to 30 and overweight if his BMI is greater than or equal to 25. The following classes of BMI allow to assess obesity among adults: obese class I: BMI between 30 and 34.99; obese class II: BMI between 35 and 39.99; obese class III: BMI \geq 40. Another method widely used classifies obese as follows: moderate obesity: BMI between 30 and 34.9; massive obesity: BMI between 35 and 39.99; morbid obesity: BMI greater than 40. Obesity is also an imbalance between consumption and energy expenditure [12, 13]. The proportion of obese people is increasing and by 2008,

18% of people are overweight or obese; the world has more than one billion overweight persons and 400 million are obese people [13].

Already involved in cardiovascular diseases, obesity and diabetes are considered as risk factors in the occurrence of cerebral vascular accident and of hormonal disorder [14, 15]. In addition, the prevalence of diabetes is steadily increasing among the populations, at the same time as that of obesity [1].

In Benin, the survey of the prevalence of diabetes mellitus at the beginning of the 21st century showed that 1.1 % of people are diabetic and 8% of diabetics are obese [2]. In the city of Cotonou, it was also proved that the prevalence of obesity was 9.40% and that one in ten obese people is diabetic [16].

The above considerations motivated us to undertake investigations on the prevalence of diabetes mellitus among obese people. Then, this study aimed to gather local data on the prevalence of diabetes mellitus in obese individuals, in the cities of Bohicon and Abomey in Benin (West Africa).

Material and methods

People surveyed are healthy obese Beninese volunteers of both sexes (having a body mass index greater than or equal to 30) with age higher or equal to 18 years old.

A representative sample of 130 people was formed (n = 130). This sample is from a detection campaign of obesity, hypertension and diabetes organized on 23rd and 25th of May 2012 in the Houndjro market at Abomey and on the bus station at Bohicon. The analyses were performed in the section of internal medicine and biomedical laboratory of Goho hospital in Zou region.

The variables studied were age, sex, anthropometric variables (height, weight, bodymass index, waist circumference and capillary blood-sugar), biochemical variables (venous blood-sugar, triglycerides, total cholesterol, high density lipid -HDL- cholesterol, low density lipoprotein -LDL- cholesterol) and the type of professional activity.

People included in the study are all consenting patients with obesity and unknown diabetic condition and apparently healthy. Pregnant women and patients on diet were excluded from the study.

The data analysis was performed with Excel 2003 and statistical studies of Chi-square test using the software Epi info version 7. The test is considered significant if p ≤ 0.05.

Table 1: Distribution according to the socio-professional activity

Main activities	size	%
Vendors in the market	58	44.6
Housewives	45	34
Artisans	20	15.4
Other activities (retired, civil servants, etc.)	07	5
Total	130	100

Table 2: Distribution of sex and waist circumference according to the body mass index (BMI)

	BMI						TOTAL	%
	[30 ; 35[	%	[35 ; 40[	%	[40 ; +∞[%		
Sex								
Female	41	37.27	32	29.09	37	33.63	110	84.61
Male	13	65	06	30	01	05	20	15.38
TOTAL	54	41.53	38	29.23	38	29.23	130	100
Waist circumference								
Normal	00	00	00	00	00	00	00	00
High	54	41.53	38	29.23	38	29.23	130	100
TOTAL	54	41.53	38	29.23	38	29.23	130	100

Results

The study is focused on 130 obese men (15.4%) and women (84.6%). There is a clear predominance of the female gender with a sex ratio of 0.15. Moreover, 30% of people were aged between 40 and 49 years old, 26.20% aged from 30 to 39 years, 20.80% aged from 50 to 59 years and the average age was 42 years old.

The investigated people are from various activities sector (Table 1).

According to table1, 44.6% are vendors in the market, 34% are housewives, and 15.4% are artisans. Besides distribution according to behavior towards obesity: 105 people (80.77%) are worried about their condition, 20 people (13.38%) are proud of their condition and 05 people (3.85%) are indifferent.

Table 3: Distribution of blood-sugar level according to the BMI

Blood sugar level	BMI						TOTAL	%
	[30 ; 35[	%	[35 ; 40[	%	[40 ; +∞[%		
Normal	45	42.45	31	29.24	30	28.30	106	81.53
Hyperglycaemia	01	25	00	00	03	75	04	3.07
Diabetes	08	40	07	35	05	25	20	15.38
TOTAL	54	41.54	38	29.23	38	29.23	130	100

Table 4: Distribution of triglycerides, LDL cholesterol and total cholesterol rates according to BMI

	BMI						TOTAL	%
	[30 ; 35[	%	[35 ; 40[	%	[40 ; +∞[%		
Triglycerides (g/l)								
< 0.5	06	42.86	03	21.43	05	35.71	14	10.77
[0.5 ; 1.5 [	41	46.07	26	29.21	22	24.72	89	68.46
≥ 1.5	07	25.93	09	33.33	11	40.74	27	20.77
TOTAL	54	41.54	38	29.23	38	29.23	130	100
LDL Cholesterol (g/l)								
< 1.6	48	41.74	34	29.56	33	28.69	115	88.46
≥ 1.6	06	40	04	26.66	05	33.33	15	11.54
TOTAL	54	41.54	38	29.23	38	29.23	130	100
Total cholesterol (g/l)								
< 1.5	10	38.46	09	34.62	07	26.92	26	20
[1.5 ; 2.6 [	41	42.26	28	28.86	28	28.86	97	74.61
≥ 2.6	03	42.85	01	14.28	03	42.85	07	5.38
TOTAL	54	41.54	38	29.23	38	29.23	130	100

Table 5: Distribution of triglycerides and LDL Cholesterol rates among diabetics

	Diabetics					
	Men	%	Women	%	Total	%
Triglycerides						
< 0.5	00	00	01	100	01	05
[0.5-1.50 [	04	26.67	11	73.33	15	75
≥ 1.50	01	25	03	75	04	20
TOTAL	05	25	15	75	20	100
LDL Cholesterol						
< 1.6g/l	05	27.78	13	72.22	18	90
≥ 1.6g/l	00	00	02	100	02	10
TOTAL	05	25	15	75	20	100

Analytical Results

Table 2 shows that 41.53% of people present a Class I Obesity, 29.23% have a severe obesity and 29.23% have a morbid obesity. 33.63% of women and 5% of men present a morbid obesity. The difference among the classes of BMI is significant ($\chi^2 = 7.86$, $df = 2$, $p=0.005$)

All people have abdominal obesity. Indeed, a woman whose waist circumference is higher than or equal to 80 cm or a man whose waist circumference is higher than or equal to 94 cm is declared with abdominal obesity [13]. According to the table 3, 15.38% of people have diabetes, 3.08% are hyperglycemia and 81.54% have normal blood-sugar level. Among diabetics, 40% have a BMI between 30

and 35; 35% are severely obese and 25% are morbidly obese. The difference is not significant ($\chi^2 = 4.61$, $df = 2$, $p=0.10$).

The table 4 shows that 68.46% of people have normal levels of triglycerides against 31.54% whose have an abnormal rate. Among people with high rate of triglycerides, 25.93% have a BMI in the class [30; 35[, 33.33% are severely obese and 40.74% are morbidly obese. Among people having high rate of triglycerides, there are 4 men (14.81%) and 23 women (85.18%). The difference among the classes of BMI is not significant ($\chi^2 = 4.649$, $df = 2$, $p=0.90$).

74.61% of people have normal rate of total cholesterol, 20% have a rate of cholesterol lower than

normal rate and 5.38% have high rate of cholesterol. The difference among the classes of BMI is not significant ($\chi^2 = 1.340$, $df = 2$, $p=0.99$)

Blood-sugar level results are as seen in table 5.

According to the data in the table 5, 20% of diabetics present a hypertriglycemia among whom there are 1 man

and 3 women. The difference is not significant ($\chi^2 = 0.351$, $df = 1$, $p=0.50$).

10% of diabetics have a high rate of LDL cholesterol;

all belong to the female sex. The difference is not significant ($\chi^2 = 0.728$, $df = 1$, $p=0.50$).

Table 6: Distribution of waist circumference and of BMI among diabetics

Waist circumference	Diabetics					
	Men	%	Women	%	Total	%
Abdominal obesity	05	25	15	75	20	100
Total	05	25	15	75	20	100
BMI						
[30-35[	03	37.50	05	62.5	08	40
[35-40[	02	28.57	05	71.43	07	35
≥ 40	00	00	05	100	05	25
Total	05	25	15	75	20	100

Table 7: Distribution of diabetics according to age

Age	Diabetics					
	Men	%	Women	%	Total	%
< 20	00	00	01	100	01	05
[20-30[	00	00	00	00	00	00
[30-40[	01	25	03	75	04	20
[40-50[	03	37.50	05	62.50	08	40
[50-60[	00	00	06	100	06	30
≥ 60	01	100	00	00	01	05
Total	05	25	15	75	20	100

All diabetics have an android obesity.

According to the table 6, 40% of diabetics have type 1 obesity, 35% of diabetics have a severe obesity, and 25% of diabetics have morbid obesity.

According to the Anglo-Saxon ranking, 40% of diabetics have a moderate obesity, BMI in class [30-35], while 60% of diabetics have massive obesity (BMI ≥ 35).

These results also show that 14.81% of moderate obese people are diabetic and 15.8% of massive obese people are diabetic. The difference was significant ($\chi^2 = 5.7$, $df = 1$, $p=0.025$).

According to the table 7, 75% of diabetics are aged around 40 and older. 25% are less than 40 years old. The difference was not significant ($\chi^2 = 5.9$, $df = 5$, $p=0.12$).

30% of diabetics reported to have a family history, 10% of diabetics think they have no family history, 60% of diabetics are unaware of it. 25% of diabetics are physically active whereas 75% are sedentary.

Discussion

The high predominance of women recorded could be explained by the fact that women were more available than men and that the two days of testing and awareness

raising were conducted in markets of Abomey and at the bus station of Bohicon. These areas are usually frequented by women.

Among the 130 obese people surveyed, 20 were diabetic and mean exhibited a prevalence rate of 15.38%. This rate is certainly not national but it is close to 14.5% obtained in 2009 by Roche Institute of Obesity in collaboration with NIHMR (National Institute of Health and Medical Research) in a study conducted in France on the prevalence of diabetes in the obese people and higher than the prevalence of diabetes in non-obese adults population, which is 2% for a study carried out by Roche Institute of Obesity in collaboration with NIHMR in France [13]. Also, in a study carried out in which women aged from 30 to 55 years old were monitored for 14 years: the additional risk in the form of a non-insulin dependent diabetes mellitus (NIDDM) with obese people was 40 times higher than that of women who were thin (BMI <22) [14]. These results show that the frequency of occurrence of diabetes is higher with obese people than with non-obese people. This prevalence rate also shows that all obese people are not diabetics, which can be explained by the fact that diabetes results not only from

genetic predisposition to develop the disease but also from several other factors (age, physical activity and lifestyle).

Throughout this study, it is found that all people have android obesity. Despite this fact, only 15.38% developed diabetes mellitus. However, 80% of type 2 diabetics have been reported to suffer from obesity, especially android obesity [15, 17]. This low rate of diabetics in obese people also suffering from android obesity shows that all obese people are not diabetic and that obesity is not directly connected to the origin of the diabetic condition but could be an essential risk factor.

In the study, 14.81% of moderate obese people were diabetic, whereas 15.80% of massive obese people were diabetic. These results are higher than those found in USA and which are of 8% among the moderate obese people and of 13% among the massive obese people [18]. It could be inferred from the analysis of the data of the present study that the risk of diabetes increases linearly with BMI. It can be explained by the fact that the more people put on weight, the more metabolic disorder and homeostatic imbalance of the body are triggered. This conclusion has been confirmed by studies conducted in France in 2009 by the Roche Institute [13].

In the study, 90% of registered diabetics have an age between 30 and 60 years old. The highest prevalence is encountered starting from 40 years onwards and increases with age. These results are comparable to those previously reported regarding the prevalence of diabetes mellitus in Benin [2]. Old age is a factor triggering the occurrence of diabetes mellitus in obese people. This can be explained by the fact that older people have a very limited physical activity, sometimes even sedentary and are therefore more prone to complications of obesity as it has been reported by an earlier study [13].

Among recorded values of obese women, 13.64% are diabetic whereas 25% of men are diabetic. This male predominance has been already reported [2]. Obese men are more prone to develop diabetes mellitus than women. This report may be explained by the fact that obese men develop more abdominal obesity than women. This type of obesity triggers diabetes mellitus among obese individuals [18].

According to the study, more than 75% of identified diabetics have a professional activity of sedentary nature with limited physical activity; market vendors, dressmakers and hairdressers exhibited high values of prevalence. Actually lack of physical exercise and an unhealthy diet, both associated with the lifestyle of the industrialized countries are important risk factors for overweight and obesity. The prevalence of NIDDM is 2 to 4 times higher among the less active people than among those who are more physically active [5, 14]. From that observation, it could be inferred that physical inactivity and low physical activity are risk factors in the occurrence of diabetes mellitus among obese people. It could be easily explained by the fact that the lack of physical

activity among obese people increases the occurrence of metabolic disorders and onset of a chronic metabolic imbalance that enhances the onset of diabetes mellitus. In the study, 30% of diabetics reported to have a family history, 10% of diabetics think they have no family history, 60% of diabetics are unaware of it. The data collected do not allow us to appreciate well if heredity (family history) is a factor of risk in the occurrence of diabetes, because more than half (60%) do not know if they had a family history.

To our great surprise it is noticed that 20% of diabetics had hypertriglycemia (all are female) despite a proven android obesity. We couldn't explain this fact. Studies on the physiopathological links between obesity and diabetes have shown that rate of triglycerides is high in obese diabetic people [18].

The present study revealed that 10% of diabetics have LDL hypercholesterolemia. This low rate may be explained by the fact that the simple measurement of LDL cholesterol level does not highlight these particles, because their concentrations are often normal among obese people [19]. These low rates of diabetics with hypertriglycemia and LDL hypercholesterolemia showed that obese people may develop diabetes mellitus that is not directly connected to the amount of fat in their body.

Conclusions

To conclude, diabetes is found in obese people, obesity is not directly linked to the origin of the diabetic condition, but it triggers diabetes more than it causes it. Besides, age, sex and professional activity are risk factors for the occurrence of diabetes in obese people.

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