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Prevalence and Factors Associated with Diabetes among City Hall Workers, Bohicon, Benin

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Abstract

Introduction: Living and working conditions are increasingly conducive to a sedentary lifestyle. Many administrative workers are exposed daily to long hours of work in a prolonged sitting position, which can favour the onset of diabetes. The aim of the study was to determine the prevalence and factors associated with diabetes among workers at a town hall in Benin in 2019. **Methods**: This was a descriptive cross-sectional study conducted from December 2018 to January 2019. Exhaustive recruitment was carried out. Data were collected during a face-to-face interview, using a standardized questionnaire including socio-professional factors, behavioral factors, anthropometric measurements, and blood glucose. Frequencies were calculated. Frequencies were compared using the chi-square and Fisher tests. The significance threshold was 5%. **Results**: A total of 85 workers were included. Their mean age was 41.55 ± 9.82 years, with a sex ratio of 6.1. = The prevalence of diabetes was estimated at 8.2% [95% CI: 3.38 - 16.23%] and 3 of the workers knew they had diabetes. A family history of diabetes was associated with diabetes (p = 0.032). Occupationally, 10.77% of permanent employees had diabetes, compared with 0.0% of non-permanent employees; 12.50% of employees with at least 10 years' seniority had diabetes, compared with 7.25% of those with less seniority; 19.05% of employees who spent at least 6 hours a day sitting at work had diabetes, compared with 4.69% of those who spent less time sitting. **Conclusion:** Preventing chronic disease in the workplace is part of promoting workers' health, and must take into account occupational factors such as prolonged sitting.

Keywords

Diabetes, Prolonged Sitting, Workers-Benin

1. Introduction

Diabetes mellitus is a rapidly expanding metabolic disease. According to the World Health Organization's (WHO) Global Diabetes Report 2016, in the adult population (≥18 years), the number of people with the condition rose from 108 million in 1980 to 422 million in 2014 [1]. This corresponds to an increase in prevalence from 4.7% in 1980 to 8.5% in 2014. Diabetes is a serious disease to its mortality [1] [2]. In 2015, WHO estimated that 1.6 million deaths worldwide were directly attributable to diabetes [1]. It also predicts that by 2030, diabetes will be the 7th leading cause of death worldwide. During the period 2000 to 2012, the proportion of premature deaths (in people aged 20 to 69) attributable to hyperglycemia increased in both sexes in all WHO regions, except for women in the European region [3]. Data on diabetes in the workplace remain limited. A 2008 study of company secretaries in Bangladesh showed a prevalence of type 2 diabetes of 12.3% [4]. Older age, sedentary lifestyle, diabetes in first-degree ascendants, and high blood pressure (HBP) above 130 mmHg, were significantly associated with diabetes [4]. In India, more specifically in Bengaluru, out of 401 kindergartens, and primary and secondary school teachers, 20.7% had type 2 diabetes in 2014 [5]. In Nigeria, in Akure, a 5.3% prevalence of diabetes had been found among public service workers in 2015. Age, marital status, low level of education, body mass index (BMI) and high blood pressure (HBP) were associated with it [6]. All these studies, although carried out in the workplace, have one limitation; they do not take purely occupational factors into account. Indeed, the consideration of occupational factors in the onset of a community disease such as diabetes is not always spontaneous, either for the doctor or the patient. Prolonged sitting is a silent killer that can contribute to the onset of numerous pathologies, including diabetes. According to the recommendations of the International Labour Organization (ILO), company occupational health departments, where they exist, are responsible for implementing policies to prevent non-communicable diseases (NCDs) in the workplace. Indeed, the WHO recommends early detection and management of diabetes as part of health promotion [7]. In Benin, the prevalence of fasting hyperglycemia in the general population was 12.4%, with 4.4% in the Zou department in 2015 [8] [9]. Few statistics are available on diabetes in the workplace in Benin, despite the emergence of prolonged sitting at work as an additional risk factor for diabetes. Benin's Labor Code and General Civil Service Statute make it compulsory to set up occupational health services in both public and private establishments and to monitor workers' health. However, public services are failing to comply with these provisions. Benin's town halls, notably that of Bohicon, do not have an occupational

health department to monitor their staff or evaluate workstations. The aim of the present study was to determine the prevalence and associated factors of diabetes among Bohicon town hall workers.

2. Methods

2.1. Type of Study

This was a descriptive cross-sectional study conducted from December 2018 to January 2019.

2.2. Study Framework

The study took place in the town hall of the commune of Bohicon in central Benin. The main activities were office-based, involving the use of computers and long hours in a seated position.

2.3. Study Population and Sampling

The study population consisted of workers at the Bohicon town hall. These were workers aged over 18 with at least 6 months' seniority. The sample size was 85 workers, and recruitment was exhaustive.

2.4. Data Collection

Data collection was based on face-to-face interviews. Blood glucose levels were measured using an Accu-Chek glucometer, with the respondent fasting for at least 8 hours. Workers with a capillary blood glucose level above 1.10g/l had two venous samples taken if they were not known to be diabetic. Respondents with a fasting venous glucose level above 1.26 g/L twice, or who were on anti-diabetic treatment, were considered diabetic for the purposes of our study.

Data on socio-occupational characteristics (age, gender, marital status, education level, ethnicity, length of time at work, professional status, monthly income, daily sitting time, and work-related stress) were collected. For occupational stress, the Karasek questionnaire was used [9]. This questionnaire is a measurement scale used as a diagnostic tool to assess the constraints of the psychosocial environment at work. The Karasek questionnaire examines three dimensions of the human relationship with work. These are psychological demand (9 items), decision latitude (9 items) and social support (11 items). For each participant, the items were rated from 1 to 4 on a 4-point Likert scale, enabling their individual scores to be calculated. Decision latitude (DL) assesses each worker's ability to influence his or her work activity. It covers two dimensions: decision-making autonomy (AD) and competence autonomy (AC). A reference value of LD, equal to 70, has been adopted [9]. The score is low when it is less than 70 and high when it is greater than or equal to 70.

Psychological demand (PD) refers to the amount of work to be done, the mental demands and time constraints associated with this work. A reference PD value, equal to 21, was used. The score is low when less than 21 and high when

greater than or equal to 21. There are four possible classifications: Relaxed, active, stressed and passive. If a subject had a high LD and a low PD, he was classified as relaxed; if he had a high LD and a high PD, he was classified as active; if he had a low LD and a high PD, he was classified as stressed; and if he had a low LD and a low PD, he was classified as passive. Consequently, participants scoring < 70 on the decision latitude scale and ≥ 21 on the psychological demand scale were classified as suffering from occupational stress.

Behavioural data were collected using the WHO STEPS questionnaire, which was used to define the following variables:

Harmful alcohol consumption: 4 or more standard drinks per day for women and 6 or more standard drinks per day for men. The standard glass is the international unit for alcohol. The net alcohol content of a standard glass is 10 g of ethanol. This is equivalent to a standard beer (285 ml), a small glass of liqueur (30 ml), a medium-sized glass of wine (120 ml), or an aperitif (60 ml) [10]. Workers who had consumed harmful alcohol on at least one occasion during the 30 days prior to the survey were taken into account.

Tobacco consumption: workers considered to be tobacco consumers are those who, at the time of the survey, were regular tobacco consumers, regardless of form [10].

Fruit and vegetable consumption: daily consumption of fruit and vegetables is considered sufficient if one of the following 3 conditions is met: Average daily consumption of fruit ≥ 5 portions; average daily consumption of vegetables ≥ 5 portions; average daily consumption of fruit and vegetables ≥ 5 portions [10].

Physical activity: physical activity is considered sufficient if one of the following three conditions is met: High-intensity physical activity for 75 minutes or more per week, moderate-intensity physical activity for 150 minutes or more per week, an equivalent combination of moderate and high-intensity physical activity reaching at least 600 MET-minutes per week [11]. Metabolic equivalent (MET) expresses the ratio between metabolic rate during physical activity and metabolic rate at rest. One MET corresponds to the energy expended by a person sitting still and is equivalent to a consumption of 1 kcal/kg/hour.

Clinical data related to the personal history of diabetes, overweight by measurement of body mass index (BMI), abdominal obesity and blood pressure. Any worker with a BMI ≥ 25 kg/m^2 was considered overweight. Abdominal obesity was classified in two ways: according to the International Diabetes Federation (IDF) [12] by a waist circumference greater than or equal to 80 cm in women or 94 cm in men, and according to the National Cholesterol Prevention Program

(NCEP) [13] [14] by a waist circumference greater than 88 cm in women or 102 cm in men. Any subject with a systolic blood pressure greater than or equal to 140 mmHg and/or a diastolic blood pressure greater than or equal to 90 mmHg and any subject on antihypertensive treatment was considered hypertensive.

Although the questionnaire is based on validated WHO tool for NCD and Karasek tool for psychosocial constraints at work, prior to data collection, a pre-test of the tools was carried out in a public administration where workers are

also required to sit for long periods.

2.5. Data Analysis

Data analysis was performed with Epi-info 7.2.6 software, using proportions for qualitative variables and means with standard deviations for quantitative variables. A bivariate analysis was performed to search for associations between diabetes and independent variables. Frequencies were compared using Pearson's Chi-square test, Yates's Chis-square test and Fisher's test, according to the theoretical number of participants. The significance threshold was set at 5%.

2.6. Ethical Considerations

Authorization was obtained from the mayor's office, and informed consent was obtained from the participants. Data were collected with due respect for confidentiality and human rights. Data management and processing were carried out anonymously.

3. Results

3.1. General Population Characteristics

A total of 85 workers took part in the survey. The average age of the workers was 41.55 ± 9.82 years, with extremes of 23 and 70 years. The sex ratio (male/female) was 6.0. Among the workers, 72 (84.71%) were living with a partner, 58 (68.24%) had at least secondary education.

3.2. Prevalence of Diabetes and Hypertension

Of the 85 workers included, 7 had blood glucose levels above 1.26 g/L, for a prevalence of 8.24%; $CI_{95\%}$ [3.38% - 16.23%]. Of these workers, 3 knew they had diabetes. No cases of hyperglycemia between 1.1 and 1.26 g/L were found.

The prevalence of hypertension was 19.77% $CI_{95\%}$ [11.96% - 29.75%], 70.58% of whom knew they were hypertensive prior to the survey.

3.3. Socio-Demographic Factors

None of the socio-demographic factors were associated with diabetes. However, a higher prevalence of diabetes was observed according to age: 9.76% (>40 years) vs. 6.82% (≤ 40 years); gender: 10.53% (men) vs. 3.57% (women); education level: 14.81% (less educated) vs. 5.17% (more educated). Table 1 shows the distribution of socio-demographic characteristics according to the existence of diabetes.

Table 1. Socio-demographic factors, and diabetes among Bohicon town hall workers in 2018, (n = 85).

	Total	Diabetes n %		p-value
Age (in years)				0.922**
> 40	41	04	09.76	
≤ 40	44	03	06.82	

Continued

Gender				0.417*
Male	57	06	10.53	
Female	28	01	03.57	
Marital status				
In couple	71	06	08.45	1.000
Not a couple	14	01	07.14	
Education level				0.201*
≤ Year 4 of secondary school	27	04	14.81	
>Year 4 of secondary school	58	03	05.17	
Ethnic group				1.000*
Fon and related	71	06	08.45	
Other	14	01	07.14	

*Fisher **Yates Chi2

Table 2. Behavioral factors and diabetes among Bohicon town hall workers in 2018, (n = 85).

	Total	Diabetes		p-value
		n	%	
Harmful alcohol consumption				0.675*
Yes	21	01	04.76	
No	64	06	09.38	
Tobacco consumption				0.356*
Yes	05	01	20.00	
No	80	06	07.50	
Physical activity				0.138**
Insufficient	41	01	02.44	
Sufficient	44	06	13.64	
Fruit and vegetable consumption				1.000*
Insufficient	74	06	08.11	
Sufficient	11	01	09.09	

*Fisher **Yates Chi2

3.4. Behavioral Factors

Among the workers, 21 (24.71%) had consumed harmful alcohol in the 30 days prior to the survey.

The prevalence of diabetes was 4.76% among alcohol users versus 9.38% among non-users. With regard to tobacco consumption, 5 (5.88%) smoked tobacco; the prevalence of diabetes was 20% among tobacco users versus 7.5% among non-users. A total of 41 (48.23%) had insufficient physical activity, and the prevalence of diabetes was 2.44% among workers with insufficient physical activity versus 13.64% among those with sufficient physical activity. Among the workers, 74 (87.05%) consumed less than 5 portions of fruit and vegetables per day, and a frequency of 8.11% of diabetes in those with insufficient consumption vs. 9.09% in those with sufficient consumption of FEL was obtained. None of the behavioural factors were associated with diabetes. Table 2 shows the distribution of behavioral characteristics according to the existence of diabetes.

Table 3. Anthropometric, clinical and diabetes factors in Bohicon town hall workers in 2018, (n = 85).

		Diabetes		p-value
Total		**n**	**%**	
Abdominal obesity according to NCEP score				0.665*
Yes	20	02	10.00	
No	65	05	07.69	
Abdominal obesity by IDF score				1.000**
Yes	48	04	08.33	
No	37	03	08.11	
BMI				0.697*
Overweight/Obesity	51	05	09.80	
Lean/Normal	34	02	05.88	
Family history of diabetes				
Yes	10	03	30.00	**0.032***
No	75	04	05.33	

*Fisher **Yates Chi2

3.5. Anthropometric and Clinical Factors

The average BMI of the workers was 23.93 ± 5.10 kg/m². Of the workers, 51 (60.0%) were overweight. The prevalence of diabetes was 9.80% in overweight workers versus 5.88% in normal-weight workers. According to the IDF classification, 48 (56.47%) were abdominally obese. The incidence of diabetes was 8.33% in the obese versus 8.11% in the non-obese. A family history of diabetes was found in 10 (11.76%) workers, with an incidence of diabetes of 30% in those with a family history of diabetes versus 5.33% in those without a family history. Only a history of diabetes was associated with the onset of diabetes (p = 0.032). Table 3 shows the distribution of anthropometric and clinical characteristics according to the existence of diabetes.

3.6. Professional Factors

Occupationally, there were 65 (76.47%) permanent workers, and the proportion of diabetes was 10.77% among permanent versus 0.0% among non-permanent workers. A total of 16 (18.82%) workers had more than 10 years' seniority, among whom the frequency of diabetes was 12.50% versus 7.25% among those with less seniority. Among the 12 (14.11%) workers with an average declared income of over 100,000 CFA, the proportion of diabetes was 16.67%, compared with 5.66% among the lowest paid. Of the 21 (27.71%) workers who spend more than 6 hours a day sitting at work, 19.05% had diabetes, compared with 4.69% of those who spend less than 6 hours sitting. Occupational stress according to Karasek was observed in 17 (20.0%) workers, among whom a diabetes frequency of 5.88% was found, compared with 8.82% in the non-stressed group.

Statistically, none of the occupational factors was associated with the onset of diabetes. Table 4 shows the distribution of occupational characteristics according to the existence of diabetes.

Table 4. Occupational factors and diabetes among Bohicon town hall workers in 2018, (n = 85).

	Total	Diabetes		p-value
		n	%	
Professional status				
Permanent employees	65	07	10.77	-
Non-permanent	20	00	-	
Length of service (in years)				0.611*
> 10	16	02	12.50	
≤ 10	69	05	07.25	
Monthly income (in F CFA)				0.227*
≥100000	12	02	16.67	
<100000	53	03	05.66	
Daily time spent sitting at work (in hours)				0.059*
>6	21	04	19.05	
≤6	64	03	04.69	
Stress at work				1.000*
Yes	17	01	05.88	
No	68	06	08.82	

*Fisher

4. Discussion

The aim of this study was to determine the prevalence and factors associated with diabetes among workers at Bohicon town hall. At the end of the study, the prevalence of diabetes was 8.24%, and the only associated factor was a family history of diabetes.

In comparison with general population studies in Benin, the prevalence of 8.24% obtained in the present study is close to the 6.7% found by Amoussou Guenou *et al.* [15] in 2014, and higher than the 4.6% found in 2007 by Djrolo *et al.* [16].

In the workplace, also in the tertiary sector, this prevalence is lower than those found by Nazmul Ahasan *et al.* [4] in 2008 among secretaries in Bangladesh (12.3%) and Manjula *et al.* [5] in 2014 among kindergarten teachers in the Indian city of Bengaluru (20.7%). This difference may be due to the specificities of each country in terms of genetic predisposition and dietary habits, but also to the realities linked to sedentariness in these professions. Other studies, such as that by Aladeniyi *et al* [6], found a prevalence of 5.3% among Akure civil servants in Nigeria in 2015, a figure lower than ours. This difference could be linked to their larger sample size than ours.

The prevalence of diabetes obtained in the present study increases with age, although the relationship is not statistically significant. This result is similar to those found in the workplace by Nazmul Ahasan *et al.*, who found a peak in prevalence in subjects over the age of 50 [4]. Manjula *et al* showed an increase in prevalence from 10.9% in subjects aged 31 to 40 to 48.5% in those aged 51 to 60 years [5]. In the 2015 survey of Nigerian civil servants, Aladeniyi *et al.* found a significant association between age and diabetes [6]. Subjects over the age of 45

were twice as likely as others to be diabetic.

The only statistically associated factor was a family history of diabetes. Numerous studies demonstrate a strong association between heredity and the onset of type 2 diabetes due to inheritance traits predisposing to insulin resistance; obesity and/ or accelerated loss of insulin-secreting function of β-cells [17]. Our results point in this direction, showing a statistically significant association between a family history of diabetes (in first-degree relatives) and diabetes. Participants with this history had a prevalence 5.62 times higher than others. A similar observation was made by Nazmul Ahasan *et al.* [4] and Manjula *et al.* [5]. The same observations were made by Amoussou-Guenou *et al.* [15], Uloko *et al.* [18] Dasappa *et al.* [19]. Since genetic factors cannot be changed, it is possible to control obesity, which is an important element in the fight against diabetes [20].

A number of other factors are expected but have not been found to be statistically associated, despite apparently varied prevalences across categories.

According to the literature, this correlation between age and diabetes has also been reported by authors working in the general population. Indeed, Amoussou-Guenou *et al.* [15] in 2014, Djrolo *et al.* [16] in 2007 and Dasappa *et al.* [19] in 2013 also found a significant association between advanced age and increased diabetes prevalence. This is due to the fact that, with aging, the functions and proliferative capacity of pancreatic cells decline, leading to a higher risk of developing diabetes.

The prevalence of diabetes was higher in men than in women, at 10.5% and 3.6% respectively. However, there was no significant relationship between diabetes and gender ($p = 0.417$). The same results were reported by Fagot-Campagna *et al.* [21] in France in 2010. However, our results differ from those of Aladeniyi *et al.*, Djrolo *et al.* and Amoussou-Guenou *et al.* [6] [15] [16] who found a similar prevalence between the sexes, while Dasappa *et al.* [19] noted a female predominance of diabetes.

The prevalence of diabetes was 5.2% and 14.8% respectively in participants with less than or equal to the fourth year of secondary education, and in those with higher education. However, no significant association was observed between education level and diabetes. Aladeniyi *et al.* [6] in Nigeria demonstrated a decrease in the prevalence of diabetes following an increase in educational level, with a statistically significant link.

However, Akter *et al.* in Bengladeh found that increased diabetes prevalence was significantly associated with higher levels of education [22]. This observation may be due to the fact that, in their study, a higher level of education was associated with a higher salary and therefore a more "affluent" standard of living generally associated with poor diet.

Participants who spent more than 6 hours a day sitting at work had a higher prevalence of diabetes. Although this risk factor was not statistically associated with diabetes, it was at the threshold of significance ($p = 0.059$). The small size of our sample may justify this finding. Several authors have reported a statistically significant relationship between sedentary lifestyle and diabetes. Nazmul Ahasan

et al., Dasappa *et al.*and Uloko et *al.* found a statistically significant association between sedentary lifestyle and diabetes [4] [18] [19]

All diabetic workers are permanent employees. This finding could be linked to the fact that permanent employees are often the oldest and have the greatest seniority in the department, and therefore have a longer period of exposure to prolonged sitting postures.

No association was found between work-related stress and diabetes status in this study. Several studies have shown the influence of work-related psychosocial factors on diabetes. Indeed, a job with a high psychological demand and a high degree of decision latitude, classifying the worker as an active subject, would have a significant impact on reducing the prediabetes stage [23].

The main implication of the present workplace study is that prolonged sitting should be taken into account when monitoring workers. Indeed, workers in prolonged sitting positions seem to present a higher risk of diabetes and deserve to be monitored more closely. In addition, all workers need to be made aware of the dangers of prolonged sitting in order to prevent it. This prevention can be achieved by following hygiene rules, which recommend regular breaks of at least 5 minutes every 2 hours to allow physical disconnection, and by practicing on-site physical activities such as stretching and walking.

At the end of the study, a campaign was carried out to raise workers' awareness of NCD risk factors, and an action plan was submitted to management, including the need to set up an occupational health department within the town hall. It should be noted that one worker had his workstation adapted by restricting his tasks to a seated position, due to the neurovascular complications he was suffering from.

This study provides information on the diabetes status of workers at Bohicon town hall. The main strengths of this study were its consideration of occupational factors and the awareness-raising actions carried out at the end of the survey. However, the study had a number of limitations. The study took into account only one blood glucose screening event, which may underestimate prevalence. Also, the small sample size affects the associations of different factors with diabetes.

5. Conclusion

The prevention of chronic diseases in the workplace is part of the health promotion actions for workers, and must take into account occupational factors such as prolonged sitting.

Thanks

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this pa-

per.

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