SHORT COMMUNICATION

Inter-relationship between type-2 diabetes mellitus, obesity and Hypertension in Nigeria

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ABSTRACT

Background: The trio; hypertension, obesity and type-2 diabetes mellitus (T2DM) share similar risk factors and frequently co-exist. This hospital-based case-control study investigated the relationship between high blood pressure, body mass index and plasma glucose concentration among persons attending Nigeria National hospital, Abuja. **Materials and methods:** After ethical approval, 45 case subjects (known T2DM) and 45 controls (non-diabetics) within the age range of 25-60 years were enrolled and their body mass index and blood pressure (BP) measured. Furthermore, the case group were subdivided into 15 Diabetic patients ≤ 5 years on treatment (group 1), 15 Diabetic patients with cardiovascular disease (group 2), 15 Diabetic patients with nephropathy (group 3) and the control group subdivided into 15 apparently healthy subjects (control 1), 15 Non-diabetic patients with cardiovascular disease (control 2), and 15 Non-diabetic patients with nephropathy (control 3). **Results:** Seventy-five (83.3 %) of both the subject and control had no family history of diabetes while only 15 (16.7 %) were reported to have family history of diabetes. There was significant association between family history of diabetes with the presence of T2DM among participants (p = 0.001). Forty-one (45.5 %) of the subjects had normal BMI as against 49 (54.4 %) that were obese. Forty-four (48.8 %) of all groups were normotensive while 46 (51.1%) had high blood pressure (> 140/100 mmHg). Similarly, 41 (45.5 %) of the subjects had normal BMI as against 49 (54.4 %). There was significant difference in the proportions of overweight among the different study groups (p =0.007). High BMI occurred mostly in diabetic subjects with nephropathy. The diabetic subjects with nephropathy and apparently health non-diabetic subjects had the most cases of high BP. There is significant difference in blood pressure among the study groups (p=0.002). **Conclusion:** Findings from this study revealed that obesity and a family history of diabetes are important risk factors for T2DM. Hence, early BP management and body weight regulation are needed to prevent DM and its complications.

Keywords: Hypertension, Type-2 Diabetics, Obesity, Non-communicable diseases

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Access this article online

Quick Response Code

website: www.bornomedicaljournal.com

DOI: 10.31173/bomj.bomj_145_16

Introduction

In recent time, there has been upsurge in the incidence of non-communicable diseases (NCD) in Africa. Nigeria is one of the countries most affected by type 2 diabetes mellitus and hypertension. Hypertension, obesity and diabetes share similar risk factors and frequently co-exist.[1]

Overweight and obesity are NCD medical disorders that have largely been attributed to sedentary lifestyle and affluence in Nigeria. It is usually defined as body mass index (BMI) ≥ 30 kg/m^2 and is assuming an epidemic dimension globally.[2] Obesity is a modifiable cardiovascular risk factor which predisposes to and occurs in combination with other NCD such as type 2 diabetes mellitus (T2DM), metabolic syndrome and hypertension.[3]

An imbalance between energy intake and its expenditure is thought to principally lead to obesity.[4]

Physical inactivity, excess caloric intake and genetic factors play significant role in aetiopathogenesis of obesity and hypertension.[4] Body mass index (BMI), is the most commonly used marker for body-weight assessment and is highly correlated with body fat.[5] In view of rising incidence of uncontrolled blood glucose and hypertension in Nigeria, this study investigated the interplay between the trio (hypertension, diabetes, and obesity).

Materials and Methods

Study design: This case-control study was conducted at the National Hospital, Abuja, Nigeria between 20th April and 30th Septem ber 2017.

Study population, ethical consideration and data collection

Participants were adults of 25 years and above who are residents of Abuja. After ethical approval, 45 case subjects (known diabetics) and 45 controls (non-diabetics) within the age range of 25-60 years were enrolled and investigated for their body mass index and blood pressure (BP). Furthermore, the case group were subdivided into 15 diabetic patients ≤ 5 years on treatment (group 1), 15 diabetic patients with cardiovascular disease (group 2), 15 diabetic patients with nephropathy (group 3) and the control group subdivided into 15 apparently healthy subjects (control 1), 15 non-diabetic patients with cardiovascular disease (control 2), and 15 non-diabetic patients with nephropathy (control 3).

BP was classified according to the Seventh Report of the Joint National Committee on High BP categories as normal (<120 mm Hg systolic and <80 mm Hg diastolic); prehypertension (120–139 mm Hg systolic or 80–89 mm Hg diastolic); or hypertension (⩾140 mm Hg systolic or ⩾90 mm Hg diastolic or use of antihypertensive medication).[6]

Body weight was measured to the nearest 0.1 kg, and height was measured to the nearest 0.1 cm, with body mass index (BMI) calculated as body weight (kg) divided by height (m) squared.

Data analysis

Data was checked for completeness and validity was ensured by double entry and random checks for errors and outliers. Analysis was done with SPSS (statistical package for social sciences), version 21 (IBM, California Inc. USA). Categorical variables were expressed as frequencies and percenta-

-ge. 95% Confidence Interval was used to assess the precision of the estimates. Chi square was used to test for relationship between categorical variables. Association between blood pressure, blood sugar and anthropometric indices were assessed. Statistical significance was set at $p < 0.05$.

Results

Findings from this study revealed that 75 (83.3%) of both the subjects and controls had no family history of diabetes while only 15 (16.7%) were reported to have family history of diabetes mellitus. There was significant association between family history of diabetes with the presence of diabetes mellitus in subjects ($p = 0.001$). Forty-one (45.5%) of the subjects had normal BMI against 49 (54.4%) that are obese.

This study also showed that 44 (48.8%) of the participants were normotensive while 46 (51.1%) had high blood pressure (> 140/100 mmHg). Similarly, the study also revealed that 41 (45.5%) of the subjects had normal BMI against 49 (54.4%). There was significant difference between the presence of overweight among the different study groups ($p = 0.007$). High BMI occurred most in diabetic subjects with nephropathy. This study also showed that 44 (48.8%) of both the subjects and control had normal blood pressure while 46 (51.1%) had high blood pressure. The diabetic subjects with nephropathy and apparently health non-diabetic subjects had most cases of high BP. There is significant difference in blood pressure between the diabetics and non-diabetic groups ($p=0.002$). Based on these findings, it can be inferred that hypertension and overweight/ obesity are significant risk factors for DM. These results indicate that early BP management and body weight regulation are needed to prevent DM and its complications.

Table 1: Distribution of Anthropometric Characteristics among Diabetic and Controls

	Cases (n=45)			**Controls** (n=45)				
Parameters	Grp 1 n(%)	Grp 2 n(%)	Grp 3 n(%)	Ctrl 1 n(%)	Ctrl 2 n(%)	Ctrl 3 n(%)	**Total** (N=90)	**p value**
History of DM								
Yes	5(31.2)	1(6.3)	3(18.7)	2(12.5)	1(6.3)	3(18.3)	15(16.7)	<0.001
No	10(68.8)	14(93.5)	12(82.3)	13(87.4)	14(93.7)	12(82.3)	75(83.3)	
BMI (kg/m²)								
25 – 29.5	5(11.1)	11(24.4)	4(8.8)	9(20.0)	7(15.5)	5(11.1)	41(45.5)	0.007
>30	10(22.2)	4(8.8)	11(24.4)	6(13.3)	8(17.7)	10(22.2)	49(54.4)	
BP (mmHg)								
120/80–140/90	15(33.3)	15(33.3)	0(0.00)	0(0.00)	8(17.7)	6(13.3)	44(48.8)	0.002
>140/90	0 (0.00)	0 (0.00)	15(33.2)	15(20.0)	7(15.5)	9(20.0)	46(51.1)	

Grp = group, Ctrl = Control

Discussion

The study showed that 55.5% of T2DM patients are obese. This is significantly more than the control counterparts. The interplay between socio-cultural lifestyle, sedentary lifestyle, high caloric energy intake and environmental factors may have contributed to the higher cases of obesity observed among the T2DM subjects as against the control that

tend to have more of normal glucose and energy metabolism.[7] Similar findings were reported by Awasthi *et al* and Ärnlöv *et al*.[8, 9] Both studies concluded that overweight and obesity without metabolic syndrome was significant risk for T2DM which were consonant with the present findings. However, in some other studies BMI performed poorly as an anthropometric measure for T2DM, but there are contrasting opinions on anthropometric measurements as risk determinants for T2DM. [10, 11]

T2DM patients are more likely to have hypertension when compared with non-diabetic persons.[12] This is in consonance with findings from this study, which showed increased cases of hypertension in diabetic subjects. This is similar to findings reported in two other studies.[13, 14] Even though it has been shown that hypertension and T2DM occur independently, there are evidences that both exacerbate each other.[15] Furthermore, we found that all the hypertensive diabetic subjects had nephropathy. A study suggests that T2DM and hypertension are highly interrelated and in majority of the cases, predisposes patients to nephropathic consequences.[16]

The etio-pathogenesis of diabetic nephropathy is highly complex and is hugely driven by the altered internal biochemistry around the renal structures which initiates multiple pathways leading to the advancement of nephropathy.[16] An altered renin-angiotensin aldosterone system in T2DM patient is also a significant contributor to the development of T2DM nephropathy and hypertension.[16]

Generalization of the findings from this study may not be feasible (limitation) because of the small sample size. However, this study revealed that hypertension and overweight/obesity are significant risk factors for T2DM. Hence, early BP management and body weight regulation are needed to prevent DM and its complications.

Conflict of interest:

None

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Cite this Article as: Musa Muhammad Babandina, Idris Nasir Abdullahi, Anthony Uchenna Emeribe, Halima Ali Shuwa, Lawal Olayemi, Peter Omale Musa. Inter-relationship between type-2 diabetes mellitus, obesity and Hypertension in Nigeria**. Bo Med J 2019;16(1): Source of Support:** Nil**, Conflict of Interest:** None declare