Prevalence of Hypertension and Diabetes Mellitus Among Individuals Attending a Health Fair in Dominica

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Abstract

Hypertension and Diabetes mellitus stands out to be one of the major diseases recorded worldwide. This has led to various responses by several organisations aiming at reducing and managing the incidence of these illnesses. Despite active involvement in combating hypertension and diabetes mellitus, recent surveys have also shown an incidence of over 1 billion hypertension cases and approximately 366 million diabetic individuals. Incidence of these diseases among the Caribbean populace have also shown similar increase, although surveys done among Caribbean islands in respect to the prevalence of hypertension and diabetes mellitus are limited. Thus this study is aimed at identifying cases of hypertensive and diabetic individuals in Dominica during a health fair. A total of 146 subjects were examined based on questionnaire and vital signs examination. Aside other parameters checked, 85(58.22%) and 47(33.58%) presented with high blood pressure and high blood glucose respectively. This study therefore highlights the need for proper awareness on the risks and complications of hypertension and diabetes mellitus among Caribbean indigene.

Keywords: Prevalence; Hypertension; Diabetes Mellitus; All Saints University School of Medicine; Health Fair; Dominica**.**

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1. Introduction

The global increase in hypertension and diabetes mellitus in recent years have been at an alarming rate and the Commonwealth of Dominica is not an exception. The rapid increase in both have led to increase in cardiovascular diseases resulting in an increase in the mortality and also comorbidity.

Blood pressure is the force of blood pushing against the wall of blood vessels. High blood pressure means the pressure in the arteries is higher than normal. Blood pressure is measured with a sphygmomanometer. Two numbers, a numerator and a denominator is obtained from the reading. The numerator, which is the systolic pressure is when the heart beats. The pressure when the heart rests between beats is the denominator and is known as diastolic pressure [1].

Normal blood pressure is 120/80 mm Hg. An adult with a systolic pressure between 120 and 139 and/or a diastolic pressure between 80 and 89 is considered to be prehypertensive. High blood pressure is when the systolic pressure is 140 or higher and/or when the diastolic pressure is 90 or higher. Hypertension is when blood pressure stays higher than 140/90 mm Hg over time. Stage one hypertension is a systolic pressure between 140 and 159 and/or a diastolic pressure between 90 and 99. Stage two hypertension is a systolic pressure that is 160 or higher and/or a diastolic pressure that is 100 or higher [2].

Worldwide, approximately 1 billion people have hypertension, contributing to more than 7.1 million deaths per year [3]. In Latin America and the Caribbean approximately one half of the 60 years and the older population are living with hypertension [4].

Various studies have shown that there are some factors that increase the risk of developing hypertension. Age has been shown to have an association with hypertension. Aging leads to increased risk of having high blood pressure. The prevalence of hypertension in the Caribbean is estimated to be 55% in studies of population over 40 years [5]. According to the Dominica STEPS Survey in 2008, the prevalence of stage one high blood pressure in male was 32.0% and in female was 32.1%. Prevalence of stage two hypertension in male is 16.3% and in female 21.3% [6].

High blood pressure that is left untreated can lead to other damaging diseases such as stroke, heart failure, peripheral arterial disease and eventually death. In Dominica, between 2006 and 2010, hypertensive diseases caused 5.2% of death in the male population and 10.4% of death in the female population [7].

Glucose is the primary source of energy and it is tightly regulated by insulin. Insulin is produced by the Beta cells of the pancreas. Diabetes is a metabolic chronic disease that occurs when the pancreas does not produce sufficient insulin (type 1 diabetes) or when the body cannot efficiently and effectively use the produced insulin (type 2 diabetes) [8]. The failure of the body to maintain a normal glucose in the blood thereby leading to an increase in the blood glucose level is termed as hyperglycemia. Hyperglycemia, a common effect of uncontrolled diabetes can lead to severe damage to the nerves, blood vessels, kidney and the general body system [8].

In 2014, 8.5% of adults that were 18 years and older had diabetes. In 2012, 1.5 million deaths were directly caused by diabetes and high blood glucose was the cause of another 2.2 million deaths [9]. Almost half of all deaths because of hyperglycemia occur before the age of 70 years [9]. According to the CDC (Centers for Disease Control and Prevention) 90-95% of diabetes cases are type 2 diabetes which is largely due to poor lifestyle habits and is largely preventable [10].

Certain risk factors including BMI, could predispose a person to developing diabetes. BMI (body mass index) can be defined as the ratio of a person's weight in kilograms to their height in meter square. It is a measure commonly used to determine if a person is under, normal, overweight or obese [11]. A BMI value less than 18.5 is considered as underweight, 18.5 to 24.9 normal weight, 24.9 to 29.9 overweight and greater than 30 is generally considered obese [12]. Obese and Overweight individuals especially those with a higher proportion of abdominal fat are at an increased risk of developing insulin resistance which is a condition where the cells in the body which are normally responsive to insulin like the muscle cells and fat cells become less responsive to insulin. This can be a major trigger for type 2 diabetes [13].

A case control study which evaluated the relationship between BMI and a diagnosis of type 2 diabetes discovered that obese and overweight individuals have a higher risk of being diagnosed with type 2 diabetes than people with normal weight. They also discovered from the research that there was a linear relationship between BMI and the risk of a diagnosis of type 2 diabetes [14].

Family history has also been identified as a possible risk factor for type 2 diabetes. A study has shown that a present family history can be a more sensitive indicator of type 2 diabetes than obesity as well as estimating the probability of having the disease [15]. Twin studies also show that there is a higher concordance rate in monozygotic twins compared to dizygotic twins [16]. Family studies have also shown that people with a first degree relative who has the disease have a 3 to 4 times greater risk of developing type 2 diabetes compared to those without a family history [17].

There are some complications that can arise from diabetes especially if it is not managed properly. Cardiovascular disease is one of the complications that can arise from unmanaged diabetes or chronic diabetes. Diabetes affects the heart and blood vessels and could especially lead to coronary artery disease which predisposes one to a heart attack or stroke. Cardiovascular disease is the leading cause of death in diabetic patients [18].

Another complication is diabetic nephropathy. Diabetes also affects the small blood vessels of the kidney leading to kidney failure. Diabetes is the most common cause of dialysis and kidney transplant [19].

Diabetes also affects the small blood vessels of the retina leading to gradual loss of vision and sometimes blindness. This is known as diabetic retinopathy. It is the most common cause of visual disability and blindness [19].

A high blood sugar also damages tiny blood vessels in the nerves especially those of the lower extremities eventually leading to numbness, pain, tingling sensations which could progress to loss of sensation. This is

known as diabetic neuropathy. This normally causes careless handling of the legs and in many cases severe infection resulting in amputation. Other nerves of the body could also be affected leading to nausea, abdominal pain and other GI symptoms as well as erectile dysfunction [20].

Cardiovascular diseases resulting from hypertension and diabetes explain about 40% of Caribbean mortality [5].

This study has been carried out at a health fair conducted in All Saints University School of Medicine by AMSA (American Medical Student Association) in Dominica. We studied the prevalence of hypertension and diabetes among its participants and associated risk factors to these diseases. Hypertension and diabetes are modifiable factors risk factors of cardiovascular diseases. It is important to know the prevalence of hypertension and diabetes and the risk factors that causes it in this area to reduce the mortality and comorbidity with other diseases. The aged population are at higher risk for this disease therefore regular checking of blood pressure and blood glucose is necessary for early detection and proper management of these diseases.

2. Materials and methods

The research was a cross-sectional study involving two modes of data collection (using a questionnaire and vitals examination), carried out at All Saints University School of Medicine located at the Commonwealth of Dominica, in the month of November 2015. A health fair was organized with a written and signed consent obtained from the university and also from each patient involved in the study.

On the day of the health fair, 15 volunteers were responsible to assess patients using a questionnaire. The questionnaire was in a history taking format that assessed variables such as demographic data, chief complaints, and history of present illness, past medical and surgical history, social history (alcohol, smoking and drugs), allergies, sexual and menstrual history and vitals. Vitals in the questionnaire were evaluated by measuring blood pressure reading, random blood glucose, body mass index (BMI) by another set of volunteers, all were carried out in separate assigned rooms. All volunteers were supervised constantly by physicians of the university. Volunteers were also advised to refer patients to the physician on-call during the event to assess patients with severe illness and severe injuries.

The various instruments used to measure vitals included: blood pressure monitors both manual and semi-automatic monitors, blood glucose monitors, automated weight and height scale and digital thermometers.

In November 28th 2015, a total of 153 patients from the city of Roseau and nearby towns and villages responded to the health fair. Data collected from the health fair through the questionnaire and physical examination were prepared into an excel file totaling to 32 variables and 153 observations. Volunteers were assigned for the organization of the 153 questionnaire and to compile data on the excel sheet. Two more volunteers were presented with the same organized questionnaire to confirm the data. The excel sheet was then imported to Stata IC 14 for analysis. Frequency distribution table to compare variables were employed and statistical significance was kept constant at $P<0.05$.

3. Results

A total of 146 subjects were examined. Volunteers consisted of 55(37.67%) males and 91(62.33%) females. Amongst the patients tested, prevalence of high blood pressure, high glucose, high body mass index, alcohol and smoking were 85(58.22%), 47(33.58%), 88(60.28%), 81(56.25) and 20(15.38%) respectively. The prevalence rates and statistical significance of various parameters against patients' blood pressure and blood glucose were calculated (Table 1). Most patients fell in the age group of 51-60 years (31) and also included the highest occurrence of high blood pressure with incidence of 24(77.42%) of which 9(29.03%) people were pre-hypertensive, 12(38.71%) had stage 1 hypertension and 3(9.68%) had stage 2 hypertension followed by the age group 41-50 years (13). Further observations showed that 55(60.44%) cases of high blood pressure were found among females (Table1). Results also shows that out of the 40 patients that were partially skilled, 24(60%) had high blood pressure while the remaining patient 16(40%) had normal blood pressure. Also those that were professionals show a high prevalence of high blood pressure 26(71.27%). A total of 94 single (unmarried) patients were attended to, out of which 46(48.94%) had a high blood pressure. In comparing marital status to high blood pressure there was a statistical significance of (P<0.05). It was observed that family history of hypertension played a vital role in the incidence of high blood pressure. Out of the 69 patients with a family history of hypertension 43 (62.33%) had high blood pressure. Patient who are overweight and obese had high blood pressure when body mass index was compared with high blood pressure, 29(65.91%) for overweight patients and 38(86.37%) for obese patients respectively which also had a statistical significance of P<0.05 (Table 1)

In comparing the blood glucose level with age, 61-70 years' age group were with highest the occurrence 11(34.48%) followed by 21-30 years' age group 8(36.34). High blood glucose was observed among males 20(37.73%) in (Table 1). Research also shows that patients who were single (unmarried) had a normal blood glucose 61 (68.54%) compared to those that were married.

It was also observed among patients that had a normal glucose level 93 in total, 57 (59.14%) of them had high blood pressure even though while comparing glucose to high blood pressure there was no statistical significance P>0.05.

Though there was no statistical significance P>0.05 when tobacco smoking was compared to blood glucose (Table 2). 31 people out of the 140 patients who had their body mass index checked had high blood glucose level.

Patient's family history played no significant role in incidence of high blood glucose. It was observed that patients with high blood glucose were only 25(39.06%) out of 64 that had a family history of diabetes.

Patients Job did not really have much effect on the blood glucose level as only 12(30.77%) who are partially skilled had a high blood glucose level and 18(28.57%) who are unskilled had a high blood glucose.

Table 1: Comparison between blood pressure (>120/80mm Hg) and blood glucose (>100mg/dl) based on age, gender and BMI (overweight and obese)

Baseline Characteristics	Blood Pressure (>120/80mm Hg)	Blood Glucose (>100 mg/dl)	P-value (BP and Glucose)
Age	51-60 years	61-70 years	0.001 and 0.532
Male	30(54.54%)	20(37.73%)	0.857 and 0.684
Female	55(60.44%)	27(31.01%)	
Overweight (BMI 25-30)	29(65.91%)	13(32.50%)	0.000 and 0.673
Obese (BMI >30)	38(86.37%)	18(40.90%)	

Table 2: Comparison between blood pressure and blood glucose to social history

Social History	Blood Pressure				Blood Glucose		
	Normal 90-120/60-80 mm Hg n%	Pre-hypertensive 120-139/80-89 mm Hg n%	Stage 1 hypertension 140-159/90-99 mm Hg n%	Stage 2 hypertension > 160/100 mm Hg n%	Normal <100mg/dl n%	Impaired 100 mg/dl to 125 mg/dl n%	Diabetes >126mg/dl n%
Smokers	9 (45.00%)	5 (25.00%)	4 (20.00%)	2 (10.00%)	13 (65.00%)	4 (20.00%)	3 (15.00%)
Non-smokers	45 (42.86%)	28 (26.67%)	27 (25.71%)	5 (4.76%)	65 (65.00%)	21 (21.00%)	14 (14.00%)
Alcohol consumers	33 (40.74%)	26 (32.10%)	19 (23.46%)	3 (3.70%)	54 67.50%)	18 (22.50%)	8 (10.00%)
Non Alcohol consumers	27 (43.55%)	15 (24.19%)	15 (24.19%)	5 (8.06%)	37 (64.91%)	9 (15.79%)	11 (19.30%)

It was also observed that among patients who were smokers 11 (55%) had high blood pressure compared to patients who were non-smokers 55 (57.14%) Table 2.

Alcohol consumers showed a higher prevalence of high blood pressure 48 (59.26%) compared to non-alcohol consumers 35 (56.44%) Table 2.

4. Discussion

Amongst several factors, the incidence of Diabetes Mellitus (DM) and Hypertension (HTN) serves as major

cause of coronary heart disease, heart failure and cerebrovascular disease [21]. As a result they arise as key medical and public health concerns worldwide. Recent estimates by International Diabetes Federation (IDF) in 2011 revealed that 366 million individuals worldwide had DM [22]. Although, WHO predicted a total of 300million cases in year 2025, studies from IDF may suggest a rapid trend in the occurrence of DM [23]. HTN on the other hand have observed to affect roughly 1 billion on the globe with estimates to reach 1.56 billion in 2025 [24]. Despite the deadly risk of these diseases when they occur solely, it has been observed that HTN and DM have a strong correlation, thus leading to their co-existence [25]. Studies done among the Caribbean population has also shown similar trend with increasing occurrence of DM and HTN [26, 27].

This study utilized the relationship between high blood pressure (HBP) and hypertension in determining the prevalence of individuals with increased hypertensive risk. Similar correlates were also used in linking high blood glucose (HBG) to DM. Vital signs showed appreciable prevalence of HBP with increased incidence amongst the age group of 51-60years. The manifestation of more case of HBP among the middle aged and elderly could be due to the loss of the cushioning role of vessels which could be attributed to the lack of the visco-elastic properties of the vessels or the presence of underlying disease like arterial sclerosis or DM, which could lead to the stiffening of vessels [28]. Also, renal insufficiency associated with age could lead to increased salt retention, thus increasing blood pressure (BP) [29].

The possibility why professional workers (sedentary jobs) showed 71.27% prevalence of HBP could be due to lack of physical exercise, which increases the risk for cardiovascular diseases [30].

Since the reason for HBP is usually secondary to a defect, genetic involvement is usually 30-50% as these underlying disease may possess familial characteristics [31]. Direct genes responsible for HTN is still studied upon [32]. The 30-50% linked could suggest why 62.33% who presented with HBP had family history of HTN.

This study supported the fact that overweight and obesity could increase the chances of HBP, this is because excess weight increases blood cholesterol and triglycerides level while lowering HDL levels, thus increasing chances for plaques to develop in arteries [33]. These plaques could increase impair blood supply causing HBP [33]. It is usually believed that BMI value is usually determined by feeding habits. Studies has shown that Caribbean dwellers lack proper awareness on healthy diet thus the reason for 66.28% occurrence of overweight and obese attendees [34]. The incidence of 55% of HBP in smokers could be attributable to nicotine which functions as an adrenergic agonist, causing catecholamine and vasopressin release [35]. Respective to alcohol consumption which causes temporal HBP [36], there wasn't much difference in the occurrence of HBP between consumers and non-consumers of alcohol.

The rate of HBG though appreciably high may have some limitations. This is because the nature of the health fair couldn't dictate the diet history of attendees. However, 14.29% of the participants showed sky-rocketing blood glucose readings indicating DM. This value puts Dominica in the category of Caribbean Islands with high incidence of DM [37]. 39.06% of participants with DM as well as positive family history indicates genetic involvement in the occurrence of the disease. This study showed no correlation between the prevalence of HBP and HBG.

5. Conclusion and recommendation

The prevalence of HBP and HBG in the Commonwealth of Dominica shows that HTN and DM is an issue in the Caribbean Islands. Among several attributable risk which were tested for, the prevalence of overweight and obese Dominicans appeared to be considerably high, this suggests that proper awareness of Dominicans on feeding habits may be lacking. It will also be appropriate to assume that awareness on DM and HTN may be lacking on the island, thus necessary actions should be employed in informing the society about these diseases. Awareness could be initiated by increasing the number of health fairs across Dominica and the Caribbean region.

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