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A Study of Blood Pressure and Blood Glucose among Participants Attending a Health Fair in Dominica

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Abstract

With an estimate of over 1 billion hypertensive individuals and approximately 366 million diabetic individuals, blood pressure and blood glucose tests have belonged to the group of one of the most examined parameters. Studies have also shown the death of 7.1 million individuals from high blood pressure globally. Incidence of high blood pressure and high blood glucose has been recorded in the Caribbean islands. Hence, this study is targeted towards identifying the distribution of blood pressure and blood glucose among Caribbean locals during a health fair. A total of 260 Dominicans participated during the health fair. Among which 103 (39.62%), 1 (0.38%), 73 (28.08%), 56 (21.54%) and 24 (9.23%) were normotensive, hypotensive, pre-hypertensive, stage 1 hypertensive and stage 2 hypertensive respectively. Blood glucose test showed 210 (80.77%), 3 (1.15%), 38 (14.62%) and 8 (3.08%) readings of normal, hypoglycemic, impaired and diabetic respectively. This study stresses on the need for increased care for elderly individuals among the Caribbean population. The need for proper awareness on healthy living has also been emphasized in the study.

Keywords: Blood pressure; Blood glucose; Hypertension; Diabetes Mellitus; Body Mass Index; BMI; Health fair; All Saints University School of Medicine; Dominica.

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1. Introduction

The alarming rate of increase in blood pressure and blood glucose around the world is becoming a worrisome phenomenon, and Dominica is not an exception. This increase can result in the rise in cardiovascular diseases resulting in an increase in the mortality through complications. In Dominica, between 2006 and 2010, hypertension caused 5.2% of deaths in male population and 10.4% of deaths in female population [1].

As the human heart beats, it pumps oxygen and nutrient-rich blood throughout the body. As the blood rushes, it pushes against the sides of the blood vessels which act as a pipe for transporting the blood. The force of this pushing is what is known as blood pressure. A change in the pressure can affect a person in more than one way or the other. If the pressure is too high, it puts an additional strain or stress on the arteries and the heart and this may lead to heart attacks and stroke. If the pressure is too low it may lead to poor oxygen and nutrient distribution [2].

Hypertension which is high blood pressure is usually not felt or noticed in an individual by just simple observation. There may be no sign or symptom even when readings are dangerously high. Therefore the only way is to measure ones blood pressure regularly. Blood pressure is measured in 'millimetres of mercury' (mmHg) and is written as two numbers such as 120/80mmHg. The numerator denotes systolic blood pressure, it is the highest level blood pressure reaches when the heart beats. The denominator denotes diastolic blood pressure, it is the lowest level blood pressure reaches as the heart relaxes between beats [2].

The normal blood pressure is 120/80mmHg. This is the ideal pressure for an adult who wishes to have good health and lower the risk of heart diseases and stroke. Hypertension has been defined as blood pressure consistently 140 over 90 mmHg or higher on three or more separate occasions using a blood pressure apparatus. There is no single cause for most people having high blood pressure and studies have shown that lifestyle can affect the risk of developing high blood pressure [3]. Too much salt, unhealthy diet, sedentary lifestyle, obesity, alcohol consumption are to name a few [4]. These are modifiable risk factors that can be controlled by individuals to lower the risk of developing high blood pressure.

There are also risk factors that are not modifiable such as age. As one grows older, the risk of attaining high blood pressure increase. A survey carried out in the United States showed that almost 80% of individuals aged 50 or over had high blood pressure leading to systolic hypertension [5]. Other studies have shown that this type of hypertension are less well managed, perhaps because it particularly affects the elderly [6]. It is known that premenopausal women have less stiff arteries compared with men of same age [7]. The increased arterial stiffness usually occurs after menopause and could explain the rapid cardiovascular events in elderly women. However these rates always remain lower in elderly men [8].

Ethnic origin is also another factor. High blood pressure in population of African origin, African-Caribbean and South Asian communities are widely documented especially among late childhood and adulthood [9]. In the United States, Black-White differences in blood pressure among girls become apparent from 13 years of age [10]. A study has shown that lower birth weights among Blacks accounted for Black-White differences in blood

pressure in adolescence [11].

Family history plays a vital role in the risk factors to many diseases especially cardiovascular diseases. It is not only height, hair and eye color that runs in family, high blood pressure also runs in family. If parents or close blood relatives have high blood pressure, offspring are more likely to develop it too. A recent study carried out in Sri Lanka showed that the prevalence of hypertension was significantly higher in those with a family history of high blood pressure [12].

There is also the case of low blood pressure which is known as hypotension, a condition where a person has a blood pressure lower than normal, this may be good, because the lower your blood pressure is, the lower your risk of stroke and heart disease. However, in a few cases, having low blood pressure can cause problems such as syncope, nausea, light-headedness, fatigue and depression. Some people with low blood pressure are naturally normal with no specific cause or reason, but certain health conditions and medication can lower blood pressure [13].

Blood glucose is the amount of glucose in the body, it could be more than the normal level known as hyperglycemia or lower than normal levels known as hypoglycemia. Diabetes is a disease characterized by a chronic imbalance in blood glucose levels. Diabetics that can strike at any age, although young people normally fall victims because insulin production completely cease, while those affected at later ages have some insulin production, but not enough to maintain a healthy blood glucose level [14].

After a meal, carbohydrates are converted to glucose, the glucose then enters the bloodstream. The pancreas responds to the rise in the blood glucose level by producing insulin and secreting it into the bloodstream. Insulin suppresses glucose production in the liver, it signals the liver to increase glucose uptake, and allows glucose to enter the cells from the bloodstream. As a result of this action blood glucose level falls, insulin production ceases, and homeostasis is restored [14].

Diabetes is a group of metabolic diseases characterized by hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action or both. Chronic hyperglycemia is associated with long-term damage, dysfunction and failure of different organs, including the eyes, nerves, kidney, heart and blood vessels [14].

Symptoms of marked hyperglycemia include polyuria, polydipsia, weight loss, polyphagia and blurred vision. A lot of pathogenic processes are involved in the development of diabetes. These are processes that destroy the beta cells of the pancreas with resulting consequent of insulin deficiency. Diabetes in children usually presents with severe symptoms, very high blood glucose levels, marked glycosuria, and ketonuria. In most children the diagnosis is confirmed without delay by blood glucose measurements and treatment include insulin injection [15].

Proper diabetes control depends on glucose level. When glucose levels are too low, diabetics occasionally experience hypoglycemia, or low blood sugar. Hypoglycemia typically occurs when the insulin dosage exceeds the amount needed, such as between meals. Hyperglycemia result when the body is not able to burn off sugar

through physical activities. The successful treatment for diabetes, a non-curable disease, requires that patient maintain a healthy lifestyles through diet, medication, and exercise, including eating regularly, amount of food eaten must balance with the amount of energy expended and also monitoring ones blood glucose, and take prescribed medication.

2. Materials and method

A Cross sectional study was conducted and data was collected using a questionnaire and vitals examination by organizing a health fair. The health fair was conducted in April 2016 at the All Saints University School of Medicine in Roseau, Dominica and 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, 20 volunteers were responsible to assess patients using a questionnaire, the questionnaire was in a history taking format to assess 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 measurement, 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 and an automated weight and height scale.

In the April 2016 Health fair, a total of 260 people 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 with 23 variables and 260 observations. Volunteers were assigned for the organization of the 260 questionnaires and to compile data into an excel sheet. Two other 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

The health fair accounted for 260 observations, among which 258 and 259 had their blood pressure and blood glucose examined respectively. Participants consisted of 99 (38.37%) males and 159 (61.63%) females. The most dominant age group in the selection fell into the category of 41-50 years with a standard deviation of 1.92. Analysis of blood pressure (BP) showed a presence of 103 (39.62%), 1 (0.38%), 73 (28.08%), 56 (21.54%) and 24 (9.23%) occurrence of normotensive, hypotensive, prehypertensive, stage 1 hypertensive and stage 2 hypertensive BP respectively. Blood glucose (BG) examination also showed 210 (80.77%), 3 (1.15%), 38 (14.62%) and 8 (3.08%) incidence of normal, hypoglycemic, impaired and diabetic BG readings. Data distribution and grouping of the participants based on abnormal BG and BP was tabulated (Table 1). The age

group of 51-60 years showed more cases of irregular blood pressure and blood glucose than any other age group (P<0.05). Further data analysis of age distribution showed that systolic BP had a constant annual increase of 0.33mmHg with BMI and smoking status kept constant.

Table 1: Comparison between abnormal blood pressure and blood glucose readings based on participant's history and examination

Baseline characteristics	Abnormal blood pressure (<90/60 mmHg or >120/80) n (%)	Abnormal blood glucose (<70 mg/dl or > 200mg/dl) n (%)	p-value (blood pressure and blood glucose)
Male	61 (61.61)	22 (22.22)	0.544 and 0.478
Female	93 (58.5)	27 (16.88)	0.544 and 0.478
Overweight	49 (59.76)	19 (23.17)	0.006 and 0.554
Obese	49 (65.33)	15 (20)	0.006 and 0.554
Past medical history of related diseases	57 (67.65)	25 (29.76)	0.230 and 0.001
Positive family history of related diseases.	122 (62.57)	41 (21.03)	0.152 and 0.277
Alcohol consumers	74 (57.37)	18 (14.73)	0.000 and 0.478
Tobacco smokers	14 (48.27)	7 (24.14)	0.000 and 0.842
Sedentary lifestyle	68 (72.34)	23 (24.46)	0.021 and 0.310

Married individuals appeared to have higher blood pressure readings than widows/widowers and divorced participants with incidence of 54 (54.5%) observations (P>0.05), although singles showed a higher rate of normal BP readings, with values of 75 (47.47%). Similar to BP, married attendees also had more remarks of impaired glucose (P>0.05), with record of 15 (19.23) when compared with widows/widower and divorced individuals. Detailed work up on the distribution of blood pressure and blood glucose among participants has been tabulated (Table 2).

This study showed no correlates between recreational drug usage and abnormal blood pressure or abnormal blood glucose level. The only participant with hypotensive BP reading was a girl below 10 years. Age 51-60 years presented more with prehypertensive and stage 1 BP readings, 23 (33.82%) and 19 (27.94%) respectively which was statistically significant. However, the age group of 61-70 years presented with most observations of stage 2 hypertensive BP readings with incidence of 10 (41.67%). BG readings placed 51-60 years with the highest incidence of impaired BG readings, 14 (36.64%). Diabetic BG values were more predominant among 51-70 years, 6 (12.74%).

Table 2: Detailed distribution of blood pressure and blood glucose among health fair participants centred on certain parameters

Baseline Characteristics	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 <100 mg/dl n (%)	Impaired 100 mg/dl to 125 mg/dl n (%)	Diabetes >126mg/dl n (%)
Male	37 (37.37)	31 (31.31)	19 (19.19)	11 (11.11)	77 (77.78)	16 (16.16)	6 (5.05)
Female	66 (41.51)	42 (26.42)	37 (23.27)	13 (8.18)	133 (83.13)	22 (13.75)	3 (1.88)
Overweight	33 (40.24)	21 (25.61)	18 (21.95)	10 (12.20)	62 (75.61)	15 (18.29)	4 (4.88)
Obese	26 (34.67)	19 (25.33)	19 (25.33)	11 (14.67)	60 (80)	11 (14.67)	3 (4)
Past medical history of related diseases	27 (32.14)	23 (27.38)	25 (29.76)	9 (10.71)	59 (70.24)	16 (19.05)	7 (8.33)
Postive family history of related diseases.	73 (37.44)	59 (30.26)	46 (23.59)	16 (8.21)	154 (78.97)	31 (15.90)	8 (4.10)
Alcohol consumers	55 (42.64)	39 (30.23)	26 (20.16)	9 (6.98)	110 (85.27)	14 (10.85)	4 (3.10)
Tobacco smokers	15 (51.72)	8 (27.59)	3 (10.34)	3 (10.34)	22 (75.86)	5 (17.24)	1 (3.45)
Sedentary lifestyle	26 (27.66)	28 (29.79)	27 (28.72)	12 (12.77)	71 (75.53)	19 (11.59)	3 (3.19)

Correlating BP and BG examinations (P>0.05), 13 (17.81%) individuals who had prehypertensive BP also had impaired BG values, likewise 10 (26.32%) of those with impaired glucose also had stage 1 hypertensive BP. Also 3 (12.50%) participants with stage 2 hypertensive BP reading also had BG reading >126mg/dl. Association with cigarettes showed that for every increase in the number of cigarettes, an average of 0.07mmHg increase in systolic BP was observed.

4. Discussion

Despite the strife initiated by organisations against the incidence of Diabetes Mellitus (DM) and Hypertension (HTN) as they constitute major cause of coronary heart disease, heart failure, vascular disease and cerebrovascular disease, their prevalence tend to remain at a high level [16]. This has made BP and BG test one of the vital examinations in medicine. Recent estimates by International Diabetes Federation (IDF) in 2011 revealed that 366 million individuals worldwide have DM [17]. Although, WHO predicted a total of 300million cases in year 2025, studies from IDF may suggest a rapid trend in the occurrence of DM [18]. HTN on the other hand have observed to affect roughly 1 billion on the globe with estimates to reach 1.56 billion in 2025 [18]. Also increased blood pressure has caused 7.1 million deaths globally [19]. Studies done among the Caribbean population has also shown similar trend with increasing occurrence of DM and HTN [20, 21]. This study aimed at identifying BP and BG distribution in Dominica. The extremely low distribution of hypotensive individuals demonstrate higher tendency for cardiovascular disease [22].

The age group of 51-60years and appeared more susceptible to abnormal BP and BG since physiological properties tend to become irregular due to various incidence such as reduced visco-elastic properties of the vessels, arterial sclerosis, renal insufficiency or DM [23, 24]. Cardiovascular diseases and abnormal blood glucose also related significantly among sedentary professionals. This supported studies that revealed sedentary behaviours (≤1.5 metabolic equivalents) present with more cardiovascular and metabolic crisis [25]. The lack of activity tend to increase the risk of presentation of chronic illness as metabolic markers like high density lipoprotein (HDL), triglycerides and blood glucose apt to be high [26]. The 30%-50% genetic involvement may suggest why most of the individuals with reported abnormal BP and BG had a positive family history [27]. This study also supported the fact that overweight and obesity could increase the chances of high BP and BG, by increasing blood cholesterol and triglycerides level while lowering HDL levels, thus supporting atherosclerosis [28]. Also high BMI could lead to increased insulin secretion increasing the chances for insulin resistance [29]. An increase in the incidence of high BP among smokers may be defined by the adrenergic agonistic property of nicotine, which causes catecholamine and vasopressin release [30]. Smoking also tend to increase the chances for diabetes mellitus as observed in this study [31]. Due to the effect of alcohol on the temporal artery causing giant cell arteritis, high blood pressure may arise among alcohol consumers [32]. However, this study showed more correlate with nicotine users than alcohol consumers. The study also supported similar result from Framingham data, that an increase in systolic BP is directly proportional with age [33]. The rate of alcohol consumers among individuals with impaired BG may indicate alcohol ingestion during fed state leading to hyperglycemia [33, 34].

5. Conclusion

It is generally acknowledged that appreciable incidence of hypotensive individuals in any population signify low cardiovascular risk. This link demonstrates that cardiovascular related illness among the Dominican population may be high. Thus recommendations focus on the need for proper intervention in curbing the incidence of high blood pressure among Dominicans. Rescue route may involve regular outreaches in informing the public on feeding habits and lifestyle choices. Regular health fairs with wider coverage may also appear essential. This study also shows that the aging population may be suffering from inadequate attention as most issues of high BP and high BG was observed in the advanced age group. This study also pointed out the prevalence of alcohol consumption within the population. In response, proper action in advising the public on alcohol consumption may also reduce incidence of high blood pressure as well as other metabolic disorders. Despite the population of the Island, the incidence of individuals with increasing BG were high. This proposes the need for more attention as the public may not be aware or equipped enough to contain these illnesses. We recommend ample devotion using health awareness campaigns in informing the population, promoting a healthy diet and lifestyle to all communities and providing adequate skills and facilities essential for the control BP and BG levels.

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