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ASSESSMENT OF CARDIOVASCULAR RISK FACTORS AMONG UNIVERSITY OF BELIZE STUDENTS

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ABSTRACT

Abstract: Presently there is no known reported data on cardiovascular disease risks assessment in college students in Belize. Cardiovascular disease (CVD) is the leading cause of mortality the world over. In Belize, hypertension and diabetes mellitus type two are the major metabolic disorders and among the leading causes of morbidity and mortality. Although the prevalence of these disorders have been reported in the wider population, no known comprehensive study exist among college students in Belize. **Objective:** To assess risk factors associated with developing cardiovascular diseases among college students with the aim of providing a pilot baseline data for use in planning a much larger scale study to address issues of metabolic and cardiovascular disorders among college population in Belize. **Participants:** Thirty-eight (38) registered undergraduate university of Belize students ages 17 – 30 volunteered for the study. **Methods:** Standardized protocols and procedures were used to obtain and analyze blood pressures, anthropometrics and blood chemistries among the students. **Results:** The mean for all observed results were: age 20.61 (± 3.5); BMI 23.4 (± 4.15); Systolic Blood Pressure (SBP), 116.74 mmHg. 39.47% had SBP ≥ 120mmHg. Mean biochemical studies showed: Total Cholesterol (TC) 140.89mg/dL; Triglycerides (TAG) levels for males (175.85mg/dL) were higher compared with female participants (83.17mg/dL). 13.16% had TAG above 150mg/dL while mean GLU values were observed to

be 91.85mg/dL. 64% of students had family history of CVD's; 63.16% reported eating healthy diets; 76.32% engaged in physical activity; 73.68% do not engage in harmful alcohol consumption while none (0%) of the students reported smoking cigarettes. **Conclusions:** Although some of the individuals investigated in this study had one or more risk of developing cardiovascular disease, generally majority of the students showed a low risk for the disease.

KEYWORDS: cardiovascular disease, metabolic disorders, triglycerides, glucose, BMI, cholesterol, Belize.

1.0 INTRODUCTION

Cardiovascular disease (CVD) is the leading cause of morbidity and mortality worldwide.[1] and incidentally one of the leading causes of mortality in Belize. The magnitude of this phenomenon could be attributed to several factors but changes in lifestyle play a major role. Many known modifiable risk factors for developing cardiovascular disease have been described, some of which includes sedentary lifestyle, smoking, excess body weight, unhealthy diet, raised blood pressure, blood cholesterol and glucose.[2] Furthermore, increased stiffness of the blood arteries due to deposition of plaque in the lumen of blood vessels has been implicated to have linkage with excess body weight and cardiovascular disease.[2-5] Although the manifestation of cardiovascular disease does not appear until around middle age to adulthood, the pathophysiological process for its development usually begins at an early age.[6,7]

Some of the indicative behaviors that predispose college students at higher risk for developing CVD's are overweight and obesity, which have been reported to be on the increase in this population.[8, 9] For instance, weight gain for the duration of college years has been observed to be higher than in general population when studied over the same period of time.[10] Also, the phase of transition from adolescence to becoming young adults renders college students more vulnerable to increased risk for overweight and the development of obesity. The college period also corresponds with changes in socio-behavioral attitudes where students cultivate patterns for exercise, diet and other risky behaviors that may increase their risks for developing CVD's.[11, 12] In addition to obesity and overweight, some of the risk factors for developing cardiovascular disease among college students, long hours of sedentary work[13]; low physical activity [14]; smoking[15, 16] and alcohol consumption[17] have been widely reported.

A number of the modifiable risk factors for developing CVD's identified and described elsewhere are also prevalent in Belize with the attendant observable consequences. In 2009 for instance, the Pan American Health organization (PAHO), reported that non-communicable diseases such as hypertension and diabetes are progressively becoming major public health concerns in Belize, in particular as reflected in the mortality rates and hospitalization records of the country.[18] A more recent Central American study[36] reported 30.3% standardized metabolic syndrome prevalence in the region with only 9.0% being free of the risks for developing metabolic disorders. The higher percentages observed in the wider population demand the need for focused studies among younger adults especially in colleges.

2.0 MATERIALS AND METHODS

2.1 Participants

The study utilized a cross sectional convenient approach and utilized only volunteers that accepted to be tested at the Medical Laboratory Teaching and Research facility. Overall, fifty-three[53] volunteered and participated in the study but in the end, only 38 (72%) students met the inclusion criteria of ages 17 – 30 years. Although all 53 volunteers were tested, results of participants not within the age range were excluded in the study. Students were included in the study if they agree to fast overnight (12hr). Recruitment of participants was by classroom announcements and through the university of Belize email system (OPI). All volunteers read and signed the approved consent form and were free to withdraw from participation any time during data collection. The study was conducted at the Medical Laboratory Technology Teaching and Research Facility, University of Belize.

2.3 Procedures and sample collection

On arrival at the laboratory trained research assistants and other researchers attended to participants. Protocols and purpose of the research were explained to the participants while written consent was obtained. The study began with an early interview by trained personnel using a standardized questionnaire and anthropometric measurements to assess cardiovascular disease risk factors as described by JNC-7.[38] Demographics, histories of tobacco/alcohol use and chronic diseases were obtained. Trained study members also conducted anthropometric, blood pressure and biochemical measurements using standard procedures as described. Height was measured using a Seca 220 stadiometer (Seca, Hamburg, Germany). Calibrated digital Seca scale was used to measure the weight of the participants as described in previous studies.[19, 20] Using the following formula: weight /height in meters^2

BMI was calculated. Participants were then taken to the research area where blood pressure and blood samples were taken for analysis. Blood pressure was measured using previously described methods.[19]

2.4 Blood Samples collection

Following a 12-hour fast and using correct aseptic methods, serum samples were collected in redtop tubes containing gel separator and clot activator. Samples were processes within one hour after collection.

2.5 Fasting Glucose Measurement

Glucose GOD-POP reagent kit was used for the determination of glucose levels in serum samples, with a reagent linearity of up to 490mg/dL and with a lower limit detection of 1mg/dL. The endpoint reaction was measured photometrically using Cyanstart – CY004 (Cypress Diagnostics, Belgium) semi-automatic biochemical analyzer.[21] Procedures were followed as instructed in the manufacturer's insert. Control sera (both normal and pathologic) were tested along with unknown samples.

2.6 Total Cholesterol

Cholesterol GOD-POP reagent kit was used for the determination of total cholesterol levels in serum samples, with a reagent linearity of up to 800mg/dL and with a lower limit detection of 3mg/dL. The endpoint reaction was measured photometrically using Cyanstart – CY004 (Cypress Diagnostics, Belgium) semi-automatic biochemical analyzer.[21] Procedures were followed as instructed in the manufacturer's insert. Control sera (both normal and pathologic) were tested along with unknown samples.

2.7 Triglycerides

Triglycerides GOD-POP reagent kit was used for the determination of triglyceride levels in serum samples, with a reagent linearity of up to 1300mg/dL and with a lower limit detection of 1mg/dL. The endpoint reaction was measured photometrically using Cyanstart – CY004 (Cypress Diagnostics, Belgium) semi-automatic biochemical analyzer.[21] Procedures were followed as instructed in the manufacturer's insert. Control sera (both normal and pathologic) were tested along with unknown samples.

2.8 Statistical Analysis

IBM SPSS statistical software was used for data analysis. Demographics were calculated using means and frequencies. Independent samples t-tests were used to examine differences between genders for anthropometric, clinical and biochemical variables. Significance was set at $p < .05$ for all tests.

2.9 Risks

Except for needle prick no risks were involved in this study. Participants had the opportunity to access free lab testing and counseling throughout the study period. Those with major identifiable health risks were referred to the Western Regional Hospital, Belmopan for further evaluation and treatment. Universal health precautions were applied at every stage of sample collection while fresh needles were used for each participant.

3.0 RESULTS

A total of 38 students participated in this study. The mean age of the students was 20.61 (± 3.5). No significant statistical age difference was seen between genders (Table 1). 26 (64%) reported family history of varying cardiovascular disorders including diabetes (52.6%); diabetes co-morbid with hypertension (44.7%); lipid & other CVS disorder (21.05%).

The World Health Organization global database on Body Mass Index was used for the classification of BMI in this study. BMI classifications used were: underweight (<18.5), normal (18.5–24.9), overweight (25.0–29.9) and obese (≥ 30.0). Although a significant difference in weight existed between genders, all groups showed a normal distribution of mean BMI that was 23.4 (± 4.15). 6 (15.79%) students were overweight while only 4 (10.53%) students had BMI of ≥ 30.0. 7.90% of the obese participants had SBP ≥ 120mmHg, which shows a correlation between obesity and high blood pressure. 7.90% of the obese students also had abnormal high SBP ≥ 140mmHg. Majority (63.16%) of students reported eating healthy diets; 76.32% engaged in physical activity; 73.68% do not engage in harmful alcohol consumption while none (0%) of the students reported smoking cigarettes.

TABLE 1. Anthropometric measurements of participants

Anthropometric, Clinical, and Biochemical Description of Students							
	All (n= 38)		Females (n= 18)		Males (n = 20)		
	Mean	SD	Mean	SD	Mean	SD	
Age (years)	20.61	3.5	20.56	3.27	20.65	3.66	
Height (in)	5.6	0.37	5.4	0.23	5.7	0.40*	
Weight (lbs)	147.65	33.33	132	13.50	161.74	39.09*	
BMI (kg/m^2)	23.4	4.15	22.8	2.57	23.9	5.11	
Note. BMI = body mass index Data analyzed using independent samples *t* tests to determine gender differences. $^*p < .05$ indicate differences between males and females.							

Table 2 presents clinical and biochemical description of students. The mean Systolic Blood Pressure (SBP) observed amongst students was 116.74 mmHg. According to JNC7 (38), SBP above 120mmHg is considered pre-hypertension and a risk factor for developing cardiovascular disease. The mean SBP in this study for all groups were within normal ranges and no significant statistical difference existed between genders. 15 (39.47%) participants [representing 9 (23.69%) males and 6 (15.80%) females] had SBP ≥ 120mmHg. Although statistical differences among genders were seen with the DBP, overall mean results were within normal range. 8 (21.05%) participants were observed to be hypertensive out of which majority (15.79%) were males while only 2 (5.26%) were females. All those with hypertension were counseled then referred to the Western Regional Hospital, Belmopan for further evaluation and possible therapy.

Total cholesterol (TC) above 200mg/dL puts an individual at risk for cardiovascular disease. The mean TC for this study was 140.89mg/dL, which was within normal range. Only one male participant had TC far above normal (493mg/dL) and was referred to the hospital for further evaluation and possible treatment.

Normal triglycerides values are usually below 150mm/dL and above this value put an individual at risk for developing cardiovascular disease. Mean Triglycerides (TAG) levels for males (175.85mg/dL) were higher compared with normal (83.17mg/dL) values observed in the female participants. Although the stated value below 150mg/dL is preferable, values close to or above 200mg/dl place individuals at risk hence the need to monitor TAG levels in the males. 5 participants representing 13.16% had TAG above 150mg/dL. Overall, the mean TAG for all participants was 131.95mg/dL and no statistical significant difference was seen between genders.

Fasting blood Glucose levels ≥100mg/dL is considered a risk factor for developing cardiovascular disease.[37] The mean fasting glucose for the males was shown to be 91.85mg/dL when compared to 87.74mg/dL observed in the females. 5 (13.16%) participants had fasting glucose levels ≥ 100mg/dL and were all males. Although no statistical difference was seen among genders the overall mean fasting blood glucose for all groups was 89.90mg/dL.

TABLE 2. Clinical and Biochemical Description of participants

Clinical and Biochemical Description of students							
	All (n= 38)		**Females (n= 18)**		**Males (n = 20)**		
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	
SBP (mm Hg)	116.74	13.56	113.22	11.84	120.15	13.77	
DBP (mm Hg)	74.5	9.47	70.67	8.05	77.95	9.32*	
TC (mg/dL)	140.89	65.73	135.5	31.20	145.75	85.34	
TAG (mg/dL)	131.95	356.82	83.17	52.10	175.85	485.19	
GLU (mg/dL)	89.90	10.90	87.74	7.39	91.85	13.0	
Note. SBP = systolic blood pressure; DBP = diastolic blood pressure; TC = total cholesterol; TAG = triglycerides; GLU = glucose. Data analyzed using independent samples *t* tests to determine gender differences. *$p < .05$ indicate differences between males and females.							

4.0 DISCUSSION

There is a universal assumption that young adults are generally healthy. With the increase in global cardiovascular disorders, care must be taken to put measures in place for the proper evaluation of young adults' cardiovascular status with a view to setting proper preventative measures to curb cardiovascular diseases from early stages of adulthood. Although some of the individuals investigated in this study had one or more risk factors for developing cardiovascular disease, majority of the students have shown low risk factors for CVD's.

A BMI of ≥ 30.0 constitutes obesity. Weight gain due to socio-behavioral changes and transitional adolescent to young adulthood has been reported to be a factor for increased obesity in college students.[24, 25] The normal BMI observed in this study could probably be attributed to the student's lifestyle. Eating healthy, not smoking and engaging in physical exercise reduces the risks of developing cardiovascular diseases. The mean BMI in this study suggest low cardiovascular risk among majority of the studied population.

The National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) proposed screening for abnormal lipid values at age 20.[26] The criterion was developed to

provide guidelines usually for the determination of metabolic syndrome and includes: measurement of waist circumference (> 102 cm for males and > 88 cm for females) to determine increase in abdominal fat; elevated fasting GLU (≥ 100 mg/dL); elevated TAG (≥ 150 mg/dL); low HDL-C (< 40 mg/dL for males and < 50 mg/dL for females), and hypertension (≥ 130 mm Hg systolic blood pressure [SBP] or ≥ 85 mmHg diastolic blood pressure [DBP]).[20, 27] Individuals that meet three or more of the criteria were considered and classified as meeting the diagnoses for metabolic disorders. Although present study was not strictly focused on describing incidents of metabolic disorders, evidence clearly suggests that metabolic disorder is an essential risk factor for the development of cardiovascular disorders both in prevalence, morbidity and mortality.[28] The study further recommended identification, prevention and management of metabolic syndrome as an important approach to reducing cardiovascular disease burden.[28] Although majority of the students who participated in this study did not meet the criteria for the developing cardiovascular disorders at this time, it is likely this could develop in the future especially if proper choices of lifestyles are not made.[29, 30, 31, 32, 33, 34] The students that presented with at least one or two risk factors or who reported familial history of cardiovascular disorders are at a heightened risk of developing CVD's when compared to those who did not present with any risk factor.[35] The need for a wider scale study with the intent of setting proper preventative measures among college students in Belize is necessary to curb the menace of CVD's.

5.0 CONCLUSION

Although some of the students investigated in this study had one or more risk of developing cardiovascular disease, overall, majority showed low risk factors for the disease. Students that presented with at least one risk factor or who reported familial history of CVS disorders could be at a heightened risk of developing CVD's compared to those who did not. The need for a wider scale study with the intent of setting proper preventative measures among college students in Belize is necessary to curb the menace of CVD's. Such studies will provide the basis for effective surveillance in control of CVD's from early age.

6.0 Limitations

The limitation of this study was the sample size that was not adequate to generate sufficient analytical power for a wider generalization. The financial cost faced by the researchers limited the number of samples and the expansion of the biochemical analysis. However, since the objective was to assess risk factors associated with developing cardiovascular diseases

among college students with the aim of providing a pilot baseline data for use in planning a much larger scale study, we believe this objective has been achieved more so that to the best of our knowledge a similar study has not been conducted among college students in Belize. This therefore makes the study unique and hence it's strength.

Conflict of interest

None declared.

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