Original Article

DOI: 10.7860/JCDR/2016/18154.7875

Health Management and Policy Section

Prevalence of Diabetes, Obesity and Dyslipidaemia in Persons within High and Low Income Groups Living in North and South Trinidad

SHIVANANDA B NAYAK[1], VALENDREA RAHMING[2], YUDESTRI RAGHUNANAN[3], CHANDANI RAGHOONATH[4], ADRIEL RAHMAN[5], DILLON RAJH[6], SHERRY RAMBADAN[7], NANDINI RAMDASS[8]

ABSTRACT

Introduction: Diabetes Mellitus, obesity and dyslipidaemia are metabolic disorders characterized by similar risk factors, complications and outcomes including stroke, insulin resistance, MI and even death. Studies have indicated that impoverished and low income areas of developing countries are more prone to increasing obesity which when uncontrolled can lead to diabetes mellitus and dyslipidaemia.

Aim: The study was aimed to compare the prevalence of diabetes mellitus, obesity and dyslipidaemia in high and low income groups of North and South Trinidad, to determine factors that contribute to its prevalence and to observe any associations between the three aforementioned diseases.

Materials and Methods: The cross-sectional study was conducted on 200 participants who visited the two major hospitals at south and north Trinidad where the mean differences between fasting glucose, lipid profile, BMI, waist and hip ratio and blood pressure of both diabetic and non-diabetic participants were obtained via questionnaires and then analysed using SPSS.

Results: Residents of south Trinidad showed a higher proportion of persons with diabetes and dyslipidaemia at 68.6% and 52% when compared to 28.6% and 27% respectively for the north population. Those from north Trinidad showed a higher prevalence of obesity at 45.9% with higher income levels. About 17.3% participants smoked or were exposed to cigarettes in north compared to 9.8% of participants whom smoked or were exposed to cigarettes in south. North had 2% of alcohol consumed daily and 3.9% consumed alcohol daily in south. In north, 21.4% of participants were stressed when compared to 18.6% from south.

Conclusion: A significant correlation was established between cholesterol, LDL and triglycerides which lead to the conclusion that obesity is caused by dyslipidaemia. Also, our study concluded that stress and dyslipidaemia are income related.

Keywords: Life style, Body mass index, Lipid profile

INTRODUCTION

Diabetes Mellitus (DM) is a chronic metabolic disorder characterised by states of hyperglycaemia caused by defects in insulin secretion, action or both. There are two major types of DM, type 1 and type 2 in which the most prevalent is T2 DM and accounts for approximately 90% of all cases of DM cases [1].

Type 2 DM is classified as a "heterogeneous" disorder caused by genetic factors in combination with insulin resistance, weakened insulin secretion and factors such as obesity, overeating, lack of exercise, aging and stress. Obesity [2] is the accumulation of energy as bodily fat and it is due to overeating of fat-rich food, enhanced sugars and starches. This combined with a sedentary lifestyle leads to an imbalance between energy intake and energy gain with the end result being obesity. Obese patients have similar risk for insulin resistance, hypertension, dyslipidaemia, CVD, stroke, sleep apnea, cancers, gall bladder disease and gout [3].

Research has shown that approximately three quarter of diabetic adults suffered from hypertension and persons diagnosed with hypertension alone are often present with insulin resistance [4]. Diabetes and Hypertension have similar exposing factors such as; racial background, family history, dyslipidaemia, and standard of living. Dyslipidaemia [5] is the elevation of plasma cholesterol, triglycerides or both or described as low High Density Lipoprotein (HDL) which can lead to formation of atherosclerosis and other cardiovascular disease (CVD) and Coronary Artery diseases.

Metabolic syndrome increases the risk for macro vascular disorders such as MI, congestive heart failure and peripheral vascular disease and microvascular diseases such as retinopathy, nephropathy and neuropathy which have been identified in patients with both hypertension and diabetes. It was reported that in people with type 2 DM the risk of Coronary Heart disease (CHD) is as much as six times greater and it is the top cause of morbidity and mortality where approximately 50% of the deaths are caused by coronary heart disease [6,7].

It is proposed that developing countries have a higher prevalence for T2DM than developed countries with 69% and 20% respectively. People aged 40 to 60 years in developing countries are more frequently affected than people over the age of 60 years in developed countries [8]. Chan et al., linked the increase to population moving towards a lifestyle expressed in the Western Hemisphere which includes an unregulated diet with diminished exercise practices in developing countries and increased overweight and obese persons [9].

It was found that the occurrence of diabetes is more prevalent among Southeast Asians than Africans, Type 2 DM was more prevalent in Africans (42%) than Southeast Asians (33.2%) [10]. According to findings females (59.5%) were more prevalent than males (40.5%). Trinidad is a country comprising people who belong to different ethnicity. It is also known that the East Indians, a major population in Trinidad are higher in number for diabetes. There is wide difference in income and quality of life of the people living in various regions of Trinidad. Therefore we attempted to determine whether the income, quality of life and the area in which they leave has any effect on the risk of diabetes and other related complications. We aimed to assess knowledge and findings on the epidemiology of diabetes, dyslipidaemia and obesity in both high and low income groups. The information we get from this

study may enlighten readers on what to expect in a multicultural population in Trinidad as well as to formulate possible hypotheses for explaining the prevalence of these three non-communicable diseases in low and high income groups of north and south Trinidad [11].

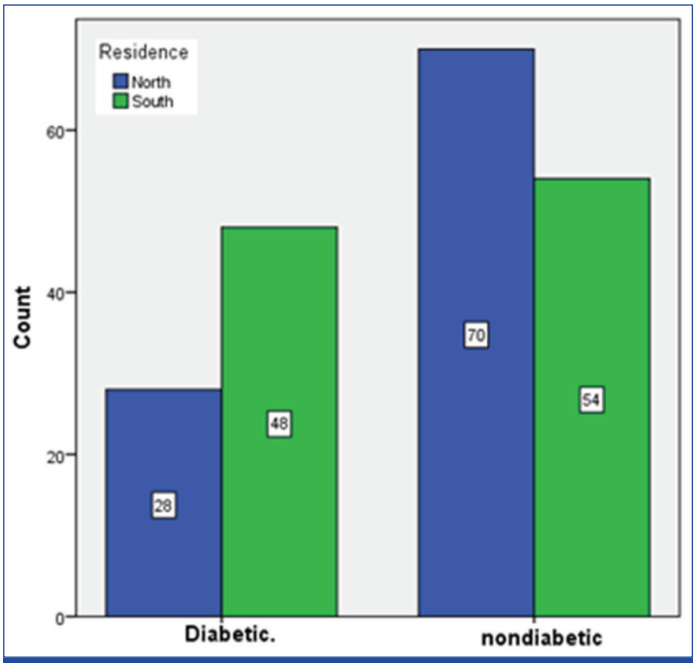
MATERIALS AND METHODS

A cross-sectional study comprised 200 participants and was conducted at the two major hospitals in Trinidad, San Fernando General Hospital and Eric Williams Medical Science Complex from September 2014 to August 2015. The selection of sample size of 200 was based on the previous published research on type 2 diabetes. The study was approved by the Campus ethics committee, University of the West Indies, Trinidad. At each hospital, questionnaires containing 20 questions concerning the participant's age, gender, ethnicity, BMI, blood pressure, diabetic status, lifestyle practices, (for example, diet, exercise routine, alcohol consumption and smoking) income levels, occupation and specific area of residence were distributed to random patients in the clinic who were willing to participate (n=200). After assisting the patients in filling out the questionnaires, the relevant anthropometric measurements (weight, height and waist to hip ratio) and blood pressure were recorded using measuring tapes, body weight scale and digital sphygmomanometer.

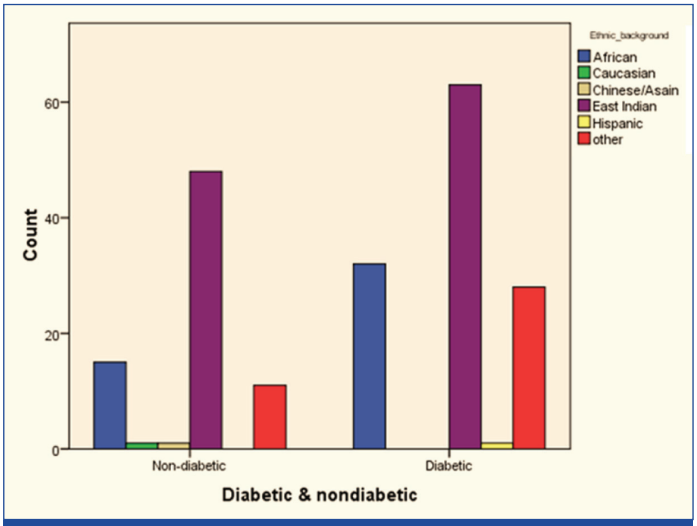
Once the data was collected and entered, nominal and ordinal data were categorized as frequencies, scale data was reported as a mean±S.D and later converted into ordinal data. This was done by recoding the original scale data into different variables. The scale data such as cholesterol, triglyceride, HDL, LDL levels, as well as their BMI, waist/hip ratios and blood pressure values were collected from the patient records. The cholesterol, triglycerides, HDL & LDL values, were all analysed by finding the mean, regarding a particular factor, residence, i.e. North or South Trinidad. The mean differences were compared using independent sample t-tests. Scale data was also analysed by using bivariate correlation to generate correlation tables. These were used to determine if there was a significant statistical correlation between certain variables. Categorical data was analysed to generate contingency tables. Calculations were done to determine BMI by computing the target variables (height and weight) into a numerical expression. Overall, a p-value of <0.05 was considered significant.

RESULTS

Residents of south Trinidad showed a higher rate of people with diabetes and dyslipidaemia at 68.6% and 52% compared to 28.6% and 27% respectively for north [Table/Fig-1]. East Indians were more in number for having diabetes when compared to other ethnicities of North and South Trinidad [Table/Fig-2]. There was significant correlation between total cholesterol, LDL and triglyceride levels when we analysed with the data collected (p<0.05). But our study did not show any significant correlation between cholesterol and HDL [Table/Fig-3]. Our study showed the significant relationship of income with obesity, dyslipidaemia and diabetes. Those from north Trinidad showed a higher prevalence of obesity at 45.9% with higher income levels [Table/Fig-4] when compared to low income group population included in the study. Participants of 17.3% smoked or were exposed to cigarettes in north compared to 9.8% of participants smoked or were exposed to cigarettes in south. North Trinidadian population had 2% of alcohol consumed every day when compared to 3.9% from in south Trinidadian population. In north, 21.4% of participants were stressed when compared to 18.6% from south [Table/Fig-5] and north population showed more heart complication than south population [Table/Fig-6]. The north population showed abnormal systolic blood pressure when compared to south Trinidadian population. Our results clearly showed that the north population comprised of low to high income group population and which were more when compared to south population. More



[Table/Fig-1]: Diabetic status of North and South Trinidadians.



[Table/Fig-2]: Relationship among the different ethnic groups with Diabetes.

number of north residents demonstrated with stress, obesity, and alcohol consumption and finally heart complications, systolic blood pressure than south population.

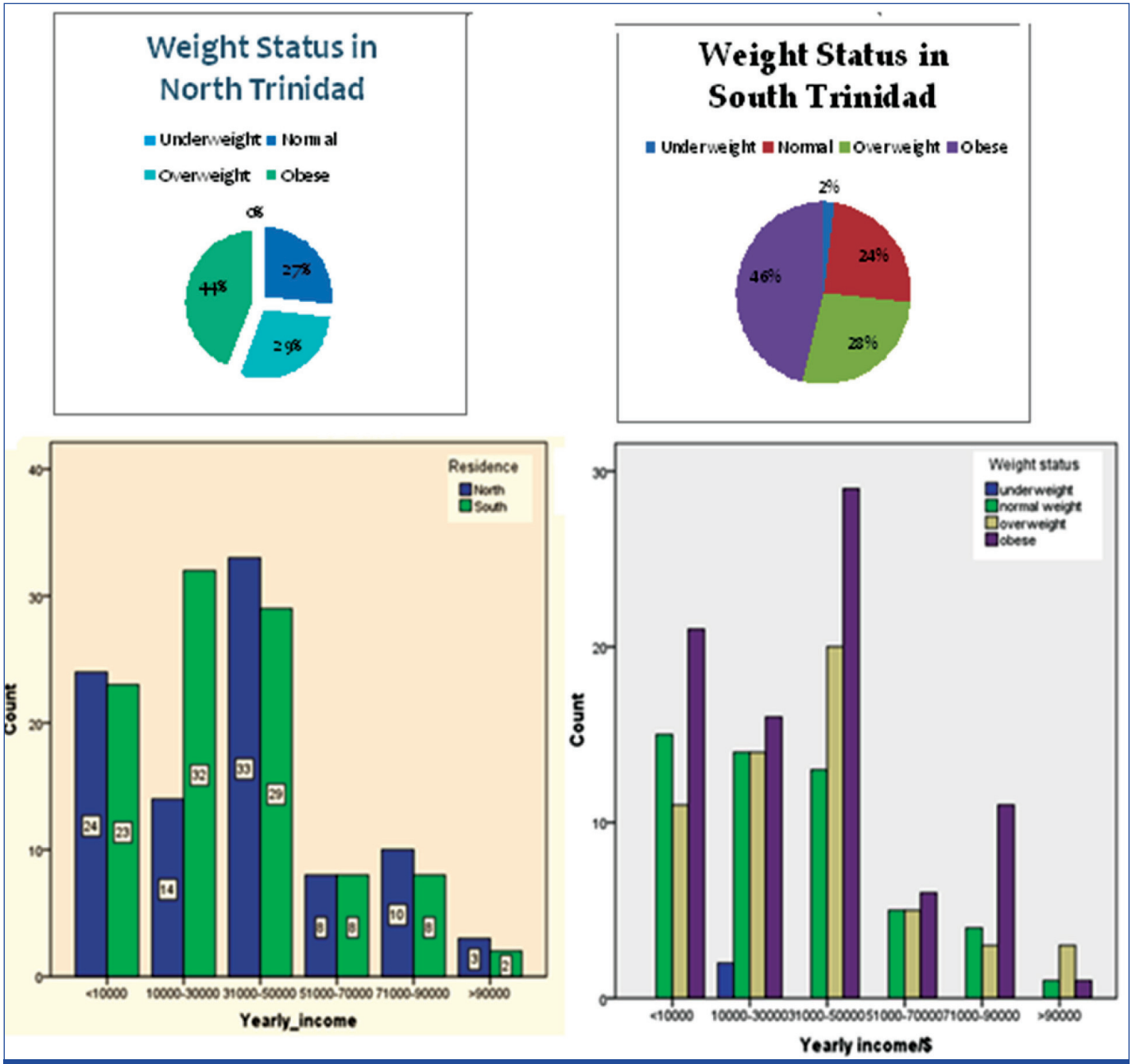
DISCUSSION

Diabetes, Obesity and Dyslipidaemia were widespread in both North and South parts of Trinidad. The sample population mainly consisted of persons over the age of 50 who were also categorized as over- weight or obese. A BMI of over 25 (cut off range of 25 to 32), physical inactivity, poor eating habits and the consumption of alcohol and cigarette smoking were the main reasons for the reported diabetes, obesity and dyslipidaemia cases.

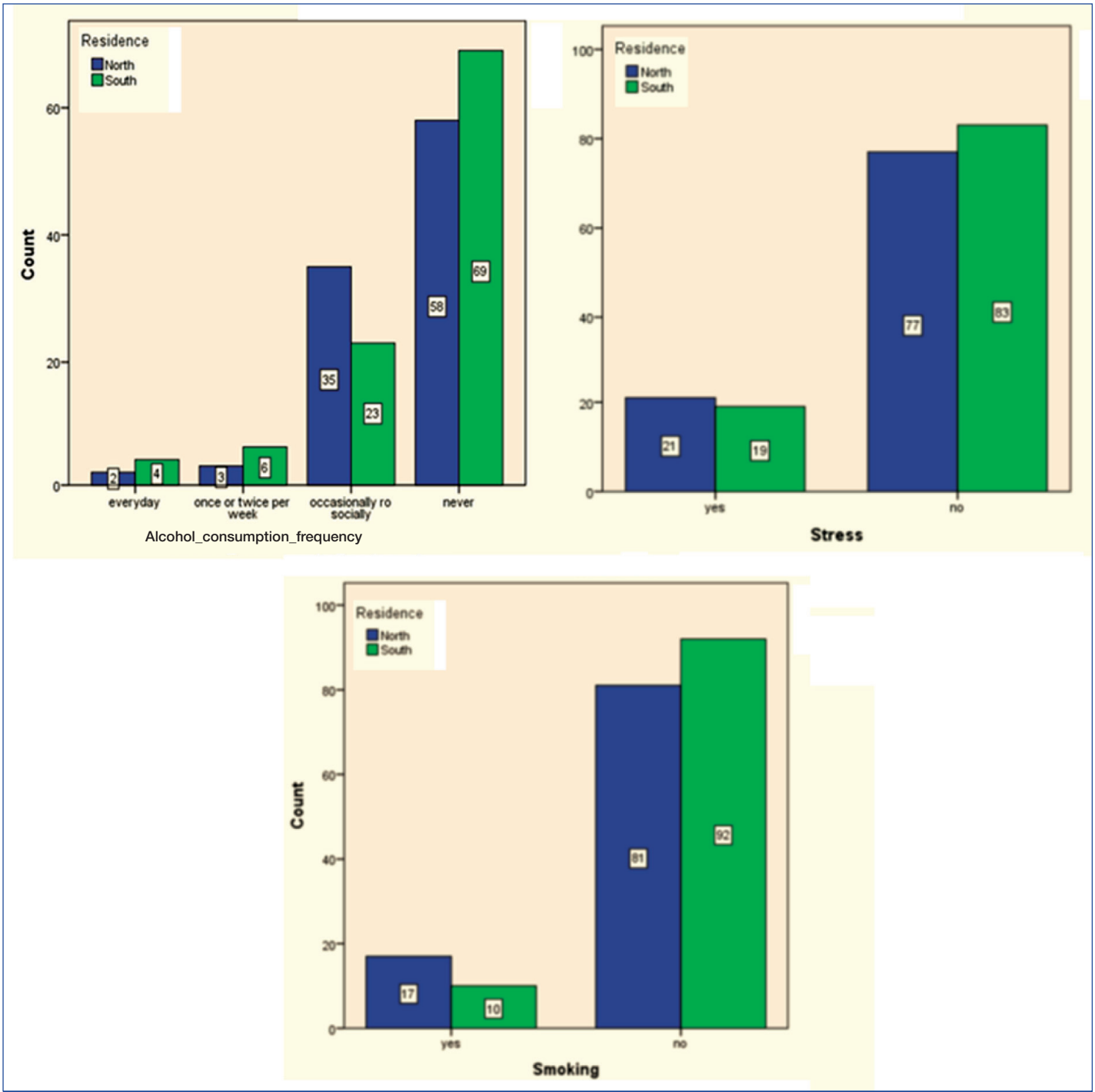
The two main ethnic groups in the study included were East Indians and Africans in which diabetes was more prevalent among the East Indians when compared to other ethnicities. However, from previous studies [12] conducted the population of Trinidad consists of two major ethnicities, Africans and Indians both of which represents approximately 35%. In the 2000 census [2] the population consisted majorly of Indians at 40.03% followed by Africans at 37.52%. The remainder of the population was scattered among Mixed, Caucasians, Chinese, and Syrians/ Lebanese people. Due to the poor life style followed in Trinidad, a trend has been established showing a higher prevalence of

		Cholesterol	Blood Glucose	LDL	HDL	Triglycerides
Cholesterol	Pearson correlation	1	.172	.672**	.095	.471**
	Sig. (2-tailed)		.030	.000	.212	.000
	N	182	160	172	175	182
Blood Glucose	Pearson correlation	.172*	1	.132	.013	.073
	Sig. (2-tailed)	.030		.104	.874	.358
	N	160	175	152	153	160
LDL	Pearson correlation	.672**	.132	1	–179*	.103
	Sig. (2-tailed)	.000	.104		.019	.177
	N	172	152	172	171	172
HDL	Pearson correlation	.095	.013	–179*	1	–.255**
	Sig. (2-tailed)	.212	.874	.019		.001
	N	175	153	171	175	175
Triglycerides	Pearson correlation	.471**	.073	.103	–.255**	1
	Sig. (2-tailed)	.000	.358	.177	.001	
	N	182	160	172	175	182

[Table/Fig-3]: Correlation between blood glucose, cholesterol, LDL, HDL and triglycerides.
* Significant (p<0.05), ** Highly significant (p<0.001)



[Table/Fig-4]: Income status and its relationship with weight of North and South residents of trinidad.

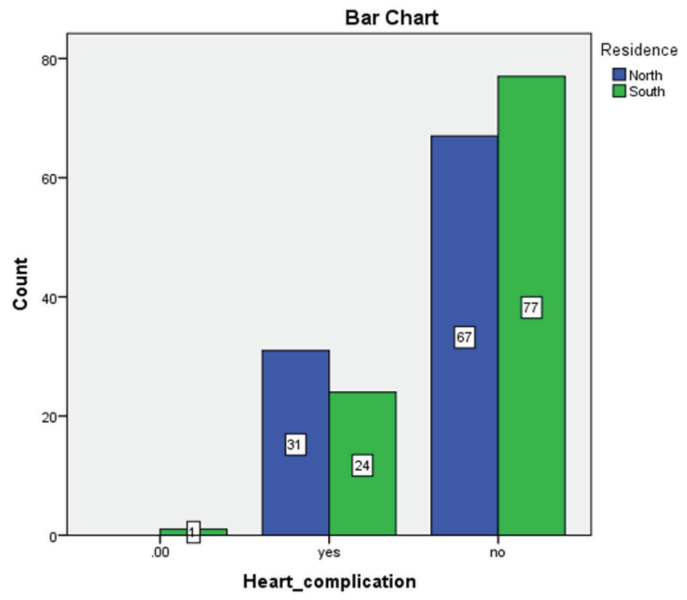


[Table/Fig-5]: Stress, Smoking and Alcohol Consumption among participants from North and South Trinidad. These are factors that contribute to the prevalence of Diabetes, Obesity and Dyslipidaemia.

diabetes in the East Indian ethnic group population when compared with others from the past years of research 1968 [13], 1986 [14] to 2013 [15].

Our study included more subjects aged 40 to 60 and were having higher prevalence for T2DM. Diabetes is also very common among the obese and middle aged population as obesity is a significant risk factor for metabolic syndromes such as diabetes and dyslipidaemia [16,17]. It has been reported [18] that the most impoverished parishes have a higher rate of obesity. It stated that fresh food is not of easy access to people of poorer areas. Also, people living in poor areas are less active due to street violence preventing persons from venturing outdoors as well as unavailability of recreational and sporting facilities. Ninety studies [19] published between 1997 and 2007 found that lower income neighbourhoods with less socioeconomic resources have higher obesity rates. This is likely due to limited chances to walk regularly or physical activity as well as insufficient access to places that sell healthier food options. In order to guide future inquiry into the determinants of obesity at a neighbourhood level, the authors used a conceptual framework comprising influence of social aspects, availability of good food and exercise, as well as personal issues. Despite the existence of individual contributing factors such as income, culture and genetics, social services for exercising opportunities and outlets for positive dietary choices are important and serve as opportunity for public health intervention.

Trinidad overall is an example of a medium-income population that is continually undergoing socioeconomic transformation and cultural changes. A rise in socioeconomic level is an important contributor to risk factors of diabetes and other chronic diseases as diet, lifestyle, and physical activity and most certainly obesity plays a role [15,20]. The poor are susceptible and have been found to have higher smoking habits, greater alcohol consumption intake, higher unsaturated dietary fats, lower vegetable intake and sedimentary lifestyle [21].



[Table/Fig-6]: Prevalence of Heart Complications in North and South Trinidad.

A report published in 2005 pinpoints some vulnerable areas of Trinidad in which Trinidad is divided into two major cities, Port of Spain and San Fernando; three Borough including Arima, Chaguanas and Point Fortin surrounded by 9 municipalities [12]. Poverty levels were unequal throughout the country and the population was divided and grouped based on level of socioeconomic status [22]. Statistics showed that in 2005, the most of Trinidad indigent population (individuals and households who are unable to secure the minimum level of resources and are extremely poor) resided in St. Patrick (33.9), Port of Spain (21%), and St. Andrew (19%) of the major cities. Overall in 2005 the poorest parts of the country were the remote north east and the south-west of the country [12]. Researchers have found that patterns in allocation of resources and differential access to care directly influence health in population sub-groups [23].

Another major finding from this study showed more persons being diabetic in South Trinidad compared to North. The South population were less inclined to take their medications and were less aware of the complications of these diseases due to their poor education about the disease and the use of proper medications prescribed. However, the levels of stress were higher in North participants and they exercised less. The North participants had a higher income than those in South because most of the North people work in academic institutions and other offices with higher education. Our study clearly showed the relationship of diabetes and other risk with income and location of the population studied.

There was also a significant relationship between high cholesterol levels and obesity. As BMI increased, the cholesterol levels also increased. The smoking and stressed population tended to be more obese compared to the non-smoking and unstressed population. Dyslipidaemia was observed more in the diabetic when compared to normal which has also been seen in previous studies conducted in Trinidad and sadly still remains consistent [21]. The government has taken many initiatives to educate the people through Television and other Medias. This study makes the recommendation of educating people about the use of medication and control of their blood lipids and sugar levels.

Management of diabetes is a necessity in Trinidad however management of diabetes in primary care falls short of Caribbean guideline recommendation [24]. Emphasis on patient education on the use of a simple glucometer, the importance of regular clinic visits and the management of the disease with proper medications and exercise and control smoking and drinking alcohol can decrease the quantity of diabetics [25].

LIMITATIONS

There were some limitations of the study conducted, such as duration of the study (6 months) and some of the participants did not provide their exact income and the exact conditions which they live.

CONCLUSION

Income level and location has been shown to influence the prevalence of the obesity, dyslipidaemia and diabetes. Therefore public health intervention should focus on culturally appropriate measures that will ease the burden of non-communicable disease in Trinidad and Tobago.

ACKNOWLEDGEMENTS

Authors would like to thank Miss Stephanie Mohammed for editing work.

REFERENCES

[1] Ozougwu J, Obiba K, Belonwu C, Unakalamba C. The pathogenesis and pathophysiology of Type 1 and Type 2 diabetes mellitus. *Journal of Physiology and Pathophysiology*. 2013;4(4):6-8.
[2] Singh A, Singh S, Singh N, Agrawal N, Gopal K. Obesity and dyslipidaemia. *Int J Biol Med Res*. 2011;2(3):824-28.
[3] Khaodhiar L, McCowen KC, Blackburn GL. Obesity and its comorbid conditions. *Clinical Cornerstone*. 1999;2(3):1-4.
[4] Long AN, Dagogo-Jack S. The comorbidities of diabetes and hypertension: mechanisms and approach to target organ protection. *Journal of clinical hypertension* (Greenwich, Conn). 2011;13(4):244-51.
[5] Anne Carol Goldberg. Dyslipidaemia. https://www.merckmanuals.com/professional/endocrine-and-metabolic-disorders/lipid-disorders/dyslipidaemia.
[6] Tillin T, Hughes AD, Mayet J, Whincup P, Sattar N, Forouhi NG, et al. The Relationship between Metabolic Risk Factors and Incident Cardiovascular Disease in Europeans, South Asians, and African Caribbeans SABRE (Southall and Brent Revisited)—A Prospective Population-Based Study. *J Am Coll Cardiol*. 2013;61(17):1777–86.
[7] Pramparo P, Finizola A, Finzola B, Gebara O, Granero R, Hill M, et al. Women and Cardiovascular Diseases in Latin America and the Caribbean. Argentina, Venezuela, Brazil, USA, Canada. Epidemiology and Prevention Council, Argentine Society of Cardiology, Buenos Aires, Argentina and the Inter American Heart Foundation, Dallas, Texas, USA; 2001. 9.
[8] Chang CH, Shau WY, Jiang YD, Li HY, Chang TJ, Sheu WH, et al. Type 2 diabetes prevalence and incidence among adults in Taiwan during 1999-2004: a national health insurance data set study. *Diabet Med*. 2010;27(6):636-43.
[9] Chan JC, Malik V, Jia W, Kadowaki T, Yajnik CS, Yoon KH, Hu FB. Diabetes in Asia; epidemiology, risk factors, and pathophysiology. *JAMA*. 2009;301:2129-40.
[10] Peter K, Paul L, Richardson R, Ramdass B, Ali A, Mungrue K. Trends in the occurrence of type 2 diabetes in community- dwelling trinidadian subjects, 1993-2014. *Int J Diabetes Clin Res*. 2015;2(026):2-4.
[11] Abegunde DO, Mathers CD, Adam T, Ortegon M, Strong K. The burden and costs of chronic diseases in low-income and middle-income countries. *Lancet*. 2007;370 (9603):1929-38.
[12] Kairi Consultants Ltd. Analysis of the Trinidad and Tobago Survey of Living Conditions. Republic of Trinidad and Tobago: Kairi Consultants Ltd; 2005. pp 299.
[13] Poon-King T, Henry MV, Rampersad F, et al. Prevalence and natural history of diabetes in Trinidad. *The Lancet*. 1998;291(7535):155-60.
[14] Beckles GLA, Kirkwood BR, Carson DC, et al. High total and cardiovascular diseases mortality in adults of Indian decent in Trinidad, unexplained by major coronary risk factors. *The Lancet*. 1986;327(8493):1298-301.
[15] Chadee D, Seemungal T, Pinto-Piereira, et al. Prevalence of self-reported diabetes, hypertension and heart disease in individuals seeking state funding in Trinidad and Tobago, West Indies. *Journal of Epidemiology and Global Health*. 2013;3(2):95-103.
[16] Reaven GM. Role of insulin in human disease. *Diabetes*. 1988;37:1595-607.
[17] DeFronzo RA, Ferrannini E. Insulin resistance: a multifaceted syndrome responsible for NIDDM, obesity, hypertension, dyslipidaemia and atherosclerotic vascular disease. *Diabetes care*. 1991;18:173-94.
[18] US News & World Report. Obesity Biggest Risk Factor for Diabetes among Poor: Study - US News [Internet]. 2012 [7 September 2014]. Available from: http://health.usnews.com/health-news/news/articles/2012/08/22/obesity-biggest-risk-factor-for-diabetes-among-poor-study
[19] Blackwell Publishing Ltd. "Lower-income Neighborhoods Associated with Higher Obesity Rates." Science Daily. www.sciencedaily.com/releases/2008/02/080207163807.htm (accessed September 7, 2014).
[20] Reddy KS, Yusuf S. Emerging epidemic of cardiovascular disease in developing countries. *Circulation*. 1998;97:596-601.
[21] Nayak BS, Butcher DM, Bujhawan S, et al. Association of low serum creatine, abnormal lipid profile, gender, age and ethnicity with type 2 diabetes mellitus in Trinidad and Tobago. *Diabetes Research and Clinical Practice*. 2011;91(3):342-47.

[22] Beaie S. 2000 Round of Population ad Housing Census Data Analysis Sub-Project: National Census Report Trinidad and Tobago. Republic of Trinidad and Tobago: Caricom Capacity Development Programme (CCDP) and Canadian International Development Agency (CIDA); 2000. pp282.
[23] Marwick C. Healthy People 2010 initiative launched. *JAMA*. 2000;283(8): 989-90.
[24] Pinto-Pereira, Hinds A, Ali I, et al. Do current standards of primary care of diabetes meet with the guideline recommendations in Trinidad, West Indies? *Primary care diabetes*. 2009;3(2):96.
[25] Nayak, BS, Gowrie, Romano R. Self-monitoring of blood glucose and its associations with glycemic control and lipid levels in type 2 diabetic patients aged 40-75 in Trinidad and Tobago. *Journal of Diabetes Mellitus*. 2012;2(3):1-7.

PARTICULARS OF CONTRIBUTORS:
1. Professor, Department of Preclinical Sciences, The University of the West Indies at St. Augustine, Trinidad and Tobago.
2. Medical Student, Department of Preclinical Sciences, The University of the West Indies at St. Augustine, Trinidad and Tobago.
3. Medical Student, Department of Preclinical Sciences, The University of the West Indies at St. Augustine, Trinidad and Tobago.
4. Medical Student, Department of Preclinical Sciences, The University of the West Indies at St. Augustine, Trinidad and Tobago.
5. Medical Student, Department of Preclinical Sciences, The University of the West Indies at St. Augustine, Trinidad and Tobago.
6. Medical Student, Department of Preclinical Sciences, The University of the West Indies at St. Augustine, Trinidad and Tobago.
7. Medical Student, Department of Preclinical Sciences, The University of the West Indies at St. Augustine, Trinidad and Tobago.
8. Medical Student, Department of Preclinical Sciences, The University of the West Indies at St. Augustine, Trinidad and Tobago.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Shivananda Nayak,
The University of the West Indies, Faculty of Medical Sciences
Department of Preclinical Sciences, Trinidad.
E-mail: shivananda.nayak@sta.uwi.edu

FINANCIAL OR OTHER COMPETING INTERESTS: None.

Date of Submission: **Dec 03, 2015**
Date of Peer Review: **Dec 17, 2015**
Date of Acceptance: **Jan 12, 2016**
Date of Publishing: **May 01, 2016**