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Research Article
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The association between socio-demographic status and the prevalence of diabetes mellitus in a deprived peri-urban population of Ghana

Abstract

Introduction: There has been growing concern recently about the rising prevalence of diabetes mellitus (DM) a diet related, non-communicable (NCD) and metabolic disease globally. DM has been linked to increasing socioeconomic status (SES) which is invariably associated with changes in both food and eating habits. This relationship is inconsistent among different populations.

Materials and methods: The purpose of this work was to investigate the relationship between socio-demographic status and prevalence of DM in a deprived peri-urban community in Ghana. It was a cross-sectional study of 171 randomly selected adult males and females aged 18-45years from 90 peri-urban households. It was part of larger study (Lysine Project) that looked at the Effect of Lysine supplementation on Indicators of Stress and Nutritional Status in a Peri-Urban Population in Ghana. Demographic and socioeconomic information were gathered from the household head. Fasting blood sugar determined. Differences and associations in the various indicators measured were tested for statistical significance using ANOVA, correlation, cross-tabulation and t-test. Logistic regression was used to determine the point estimate (Odds Ratio) and interval estimate (95% confidence interval) that measures the risk factors (age, sex, BMI). P value ≤0.05 was considered statistically significant.

Results: The mean age among subjects was 32.8±7.4years. The average prevalence of diabetes among subjects was 8.2% (6.8% for men and 9.6% for women). In general, the study observed a significant association between fasting blood glucose level and BMI (p=0.047, r=0.152). The results further revealed that there is a positive significant association between age and fasting blood sugar level among respondents (P=0.006, r=0.209). Persons from higher income household were at a higher risk (OR=3.9, CI=1.1-14.0) of becoming diabetic as compared to those from lower income households upon adjusting for household size and marital status.

Conclusion: Persons from high income households have an increased risk of becoming overweight and getting diabetes as compared to those from low income households.

Keywords: diabetes, SES, household income, fasting blood sugar

Volume 3 Issue 6 - 2016

Frederick Vuvor
Department of Nutrition and Food Science, Ghana

Correspondence: Frederick Vuvor, Department of Nutrition and Food Science, School of Biological Sciences, College of Basic and Applied Sciences, University of Ghana, Legon-Accra, Ghana, Tel +23 324 460 8344, Email fredvuvor@yahoo.com

Received: July 15, 2016 | **Published:** November 09, 2016

Introduction

Diabetes mellitus like other diet related, NCDs is rising worldwide with a projected prevalence in the next three decades to be disproportionately alarming especially in the developing countries like Ghana. It is one of the health challenges for the twenty-first century, both in developed and developing countries. It is perceived that due to the changing food and eating habit and some lifestyles as well as the increasing urbanization and economic development positively influencing the metabolism of nutrients.[1]This rise in NCD like Type 2 diabetes has been shown to parallel urbanization and changes in SES. Socioeconomic status and its constituent elements have been noted as determinant of health. In industrialized countries, SES has been shown to be inversely associated with the prevalence of type 2 diabetes mellitus.[2] However, direct association has been found between SES and diabetes prevalence in developing countries.[3] Diabetes may be up to two times more prevalent in low income populations compared to wealthy populations.[4] This relationship between SES and DM is stronger among women than men.[5] Other studies on SES in relation to DM have often used rural and urban settings to collect data in assessing the association. It has been reported that the prevalence of DM varies considerably between rural and urban areas in Ghana.[6] There have been relatively few studies on the association between DM and SES in peri-urban settings. This study examined the association between SES and DM in a deprived peri-urban adult dwellers in Ghana. Furthermore, the study provided a database for health professionals and policy makers in addressing DM scourges. The main objective of the study was to evaluate the relationship between SES and risk of DM in a peri-urban population in Accra.

Materials and methods

Blood pressure of subjects were taken using the mercury sphygmomanometer after at least 15minutes rest. Venipuncture was used to collect blood from respondents and subsequently measured with a glucometer. This was usually undertaken between 4:00 and 8:00 A.M. each day. This period was selected to avoid the likelihood of subjects eating before turning-up for blood draw and to avoid blood sugar fluctuations due to diurnal activities. A subject was classified as diabetic if fasting blood sugar (FBS) was ≥7.0mmol/l and hypertensive if blood pressure (BP) was ≥140mmHg (systolic

BP), pre-hypertensive if BP=130-139mmHg (systolic BP) and if BP <130mmHg (systolic BP). The body mass index (BMI) of each of the subjects was determined using the following formula: BMI=Weight (kg)/Height (kg/m^2). The study protocol was approved by the Institutional Review Board of the Noguchi Memorial Institute for Medical Research, University of Ghana. Potential participants of the study were given a consent form to before expressing their willingness to participate. This study was within the bigger prospective Lysine Project that looked at "Effect of Lysine on Indicators of Stress and Nutritional Status in a Peri-Urban Population near Accra, Ghana" for 112days. WHO Stepwise questionnaires were pretested to ensure clarity and validity before being used in the data collection.

Data analyses

Data were managed using SPSS version 16.0. Descriptive statistics; means, median, standard deviations, and ranges were calculated for continuous variables and proportions for qualitative variables. Differences and associations in the various indicators were tested for statistical significance using ANOVA, correlation, cross-tabulation and t-test. Logistic regression was used to determine the point estimate (Odds Ratio) and interval estimate (95% confidence interval) and factors that are consistent with the incidence of DM in the study population. P value ≤0.05 was considered statistically significant. Valuable household assets were arbitrarily assigned scores based on the monetary value. Assets with high monetary value were assigned higher scores and vice versa. Households were further categorized into three Socio-economic classes; low, medium and high based on the scores.

Results

This study consisted of ninety (90) households about 89% of the households were headed by men. The average age of the respondents was 32.8±7.4years. The average household size in the survey was 5.5. On occupation, 86% of the study population was engaged in the informal sector, mostly farming. Figure 1 displays the prevalence of diabetes across different age groups. The results show that among the respondents 3.5%, 11.3% and 9.3% were in the age ranges 18-29, 30-39 and 40-45years respectively. The prevalence of diabetes across different educational levels is displayed in Figure 2. It suggest that more cases of diabetes were found at the lower level of education. About 9.6% of them were diabetic whiles 4.7% of those with 12years of formal education were diabetic. The overall average prevalence in the study population was about 8.2%. Blood pressure values were comparatively higher among diabetics as against non-diabetics in both men and women. Mean systolic blood pressure was significantly higher in diabetics as against non-diabetics (p=0.017 and p=0.039 respectively). However, mean systolic blood pressure was only statistically higher in women but not in men (p=0.019). Mean diastolic blood pressure on the contrary was only statistically significant higher in diabetic men (p=0.041) and not in women. Among the predictors of diabetes (Table 2) was only household income levels that significantly predicted the risk of diabetes. Those from high income households, monthly income greater than or equal to fifty USD (US$170) and sixty-two Ghana Cedis (US$170), had a risk of 3.9times likelihood of becoming diabetic compared to those from households below. Persons from higher income households were still at a higher risk of becoming diabetic after adjusting for household size and marital status (OR=3.7, CI=1.1-13.3, P=0.048). The age of an individual in the study population has an influence on his/her risk of becoming diabetic (Figure 3). In the Figure 3 below, possession of wealth was used as a proxy for SES and categorized in three groups. About 11.8% of respondents from households with high SES scores were diabetic.

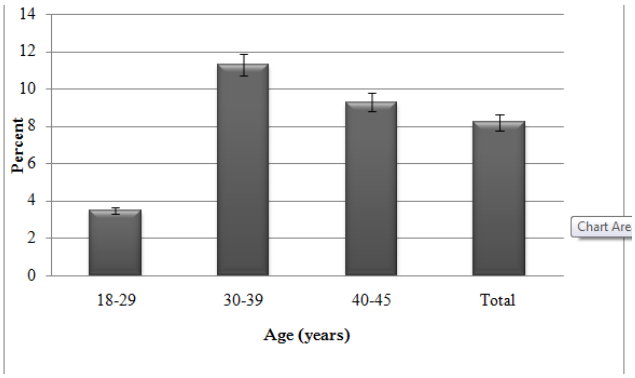

Figure 1 Prevalence of diabetes across different age groups (completed years).

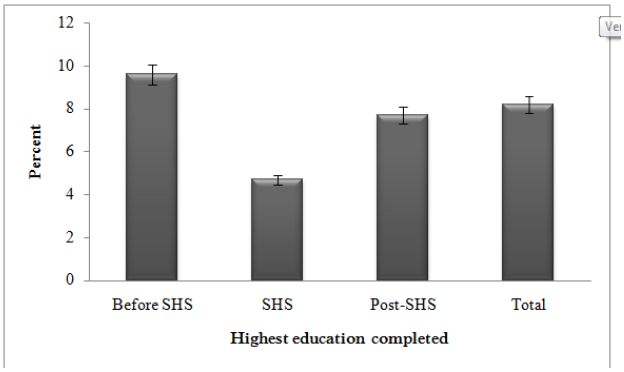

Figure 2 Diabetes prevalence across different educational levels SHS (Senior High School) i.e. 12 years of formal education.

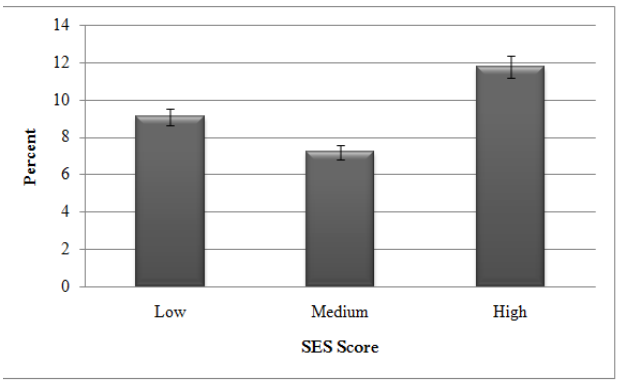

Figure 3 Association between wealth and prevalence of diabetes.

Table 1 Socio-demographic characteristics of respondents by diabetes status

Variable	Diabetic	Non-diabetic	P-value
	n(%)	n(%)	
Age (years)			
18-29	2(14.3)	55(35.0)	0.269
30-39	8(57.1)	63(40.1)	

Table continued...

Variable	Diabetic		Non-diabetic	P-value
40-45	4(28.6)		39(24.9)	
Sex				
Male	6(42.9)		82(52.2)	0.501
Female	8(57.1)		75(47.8)	
BMI (Kg/m²)				
≤25.0	6 (42.9)		103 (65.6)	0.357
≥25.0	8 (57.1)		54 (34.4)	
Systolic blood pressure (mmHg)				
<130	7 (50.0)		98 (62.4)	0.126
130-139	2 (14.3)		36 (23.0)	
≥140	5 (35.7)		23 (14.6)	
Educational level				
	11 (78.6)	104 (66.2)	0.308	
≥SSS		3 (21.4)	53 (33.7)	
Total household income (USD)1				
	5 (35.7)	110 (70.1)	0.009*	
High		9 (64.7)	47 (29.9)	
Occupation: males				
	2 (14.3)	12 (7.6)	0.583	
Self Employed		12 (85.7)	145(92.4)	
Occupation: females				
	1 (7.1)	5 (3.2)	0.395	
Blue-collar job		13 (92.9)	152(96.8)	

low income< 50USD, high income ≥50USD

Table 2 Blood pressure according to diabetes status of respondents

Variable	Diabetic (n=14)	Non-diabetic (n=157)	P-value
	Mean±SD	**Mean±SD**	
Systolic BP(mmHg)	141.36±26.40	125.01±14.75	0.017*
Diastolic BP(mmHg)	90.71±16.27	82.84±11.28	0.039*

*Statistically significant difference at P<0.05 (independent t-test

Table 3 Predictors of diabetes

Variable	OR	95.0% C.I.	p-value
Age(years)			
40-45	1.6	0.2-10.8	0.625
30-39	0.6	0.1-2.5	0.476
18-29	1	Reference	
Gender			
Women	1.7	0.4-6.4	0.457
Men	1	Reference	

Table continued...

Variable	OR	95.0% C.I.	p-value
Education			
Post-SHS	3.1	0.6-16.9	0.202
SHS	1.9	0.2-17.8	0.59
Before SHS	1	Reference	
BMI (kg/m²)			
≥25.0	1.1	0.3-3.8	0.996
<25.0	1	Reference	
Systolic BP(mmHg)			
≥140	2.6	0.3-26.3	0.426
130-139	5.6	0.8-40.9	0.087
<130	1	Reference	
Income			
High	3.9	1.1-14	0.038*
Low	1	Reference	

*Statistically significant P <0.05, OR, (Odds Ratio), Goodness- of- fit=0.954, R^2=20.2%

Discussion

The mean age of respondents in this study was 32.8±7.4years. This is a relatively younger age group and it is expected that diabetes prevalence should be low. This is because diabetes prevalence has been observed to be associated with age. This high prevalence could be attributed to the lifestyles changes due to the nutrition, demographic and epidemiological transition that are being witnessed globally. These peri urban communities in Ghana are no exception to these transitions. Household size is an important measure of SES so can be used to assess the average income of an individual in a household and can also help to determine the socio-economic status of the household in comparison to another. Majority (68%) of the households in this study areas had household size ranging from 3-6 persons. But the average household size was about 5.5 with wide variation in the study area. The average household size in Ghana is about 4.0, while the average size of rural communities is about 3.5 against 4.4 in the urban sectors.[7] This is comparatively smaller than that of 5.5 from this peri urban study community. There was no significant difference in the household size between diabetics and non-diabetics from this study.

Household income as a measure of socio-demographic status of a household was observed to be significantly associated with the risk of becoming diabetic. Using the international exchange rate at the time of this research was conducted the average monthly household income in this population was estimated to be about US$ 170.4 giving an average annual household income of US$ 2045. The average monthly household income among diabetics was considerably higher (US$ 188.5) than that of the non-diabetics (US$ 168.8). This gave an average annual household income difference of US$236.4 (US$2262 - US$ 2025.6) for diabetics and non-diabetics. Persons from higher income households (average monthly income greater than/or equal to the population mean income of US$ 170.4) were at a higher risk of becoming diabetic as compared to those from lower income

households (average monthly income of <US$ 170.4). This was statistically significant after adjusting for household size and marital status (OR=3.7, CI=1.1-13.3, P=0.048).

This corroborates with that of Boutayeb and Boutayeb (2005)[3] who conducted studies in developing countries where diabetes prevalence was found to be higher among those in higher socio-economic brackets. This could be attributed to the differences in the dietary and other lifestyle variables between the higher and lower income earners. The former are more likely to have higher consumption of refine foods with a reduced consumption of fibre rich foods which predisposes them to many chronic diseases including diabetes. Lower income earners are less likely to afford refined processed food products hence cutting down their consumption of high energy rich and refined foods thereby reducing their chances of developing many of the diet related non-communicable diseases as compared to the higher income earners, holding other non-dietary factors constant. This study did not observe any significant difference between diabetics and non-diabetics in terms of occupational status. It was observed that there was no direct relationship between occupation and etiology of diabetes but noted that an indirect connection may exist since prosperity may be associated with an increase of obesity and hence diabetes.[8] This could be explained as follows; as peri-urban communities, employment opportunities were not common. Only a few of the respondents had higher level of education, a pre-requisite for most white collar-jobs in Ghana. With majority of the respondents having either ≤SHS level of education the job prospects for them are low. It is not surprising that most of them were in informal sector.

The average prevalence of diabetes in the study population was amazingly 8.2%. The study also indicated that 6.8% of the men respondents were found to be diabetic with the proportion of diabetic women being about 9.6%. The logistic regression analysis indicated that the risk (OR) of becoming diabetic in women was about 1.7 imes (P=0.501) compared to their men counterparts. This means, a female in this population has about twice the risk of becoming diabetic as compared to the male. This is consistent with the meta-analysis of diabetes prevalence in urban and rural West Africa where the findings where no significant differences in prevalence were found between men and women.[9] Similar pattern of observation was made that the incidence of the Diabetes mellitus disease was equal in both men and women and rises with age.[10] Before the age of 45years, the incidence is about equal in men and women[11] but women outnumbered men thereafter due to hormonal differences. Logistic regression analysis revealed that the risk of becoming diabetic increased with increasing age. A person in this population aged 40-45years had a risk of 1.6times becoming diabetic as compared to another person in the same population that is less than 40years. In general, it was observed that there was a worsening glycaemia with increase age (P=0.006). Similar findings were observed in a community based study in Greater Accra.[6] This could be attributed to the body's inability to properly control sugar with aging due to insulin antagonism. Aging is also associated with increase in fat mass which is associated with hyperinsulinemia.[12,13] The study observed a significant difference in the mean age between the diabetic and non-diabetic respondents in this study (P=0.041). The association was especially stronger in men (P=0.001) but not in women (P=0.369). It can be inferred that diabetes prevalence could be worse for people above 45 years as this age group has been reported to have the greatest proportion of diabetic cases in developing countries like Ghana.[14]

The rising prevalence of diabetes in Ghana has been observed in several studies, 0.2% in the 1960s, 3.5% in the mid-1970s.[15] In 2002 prevalence of 3.9% was recorded and,[16] Amoah et al. reported a 6.4% prevalence in a community based study in Accra.[6] Though none of these studies is a nationwide study, the findings have serious implications for Ghana that demands urgent attention. The rise in non-communicable diseases, of which diabetes is one, has been blamed on demographic and nutrition transition, a situation that has drawn global attention recently. In Ghana, for instance, urbanization has been shown to be on the rise from 29% in 1970; to 44% in 2000;[17] to about 47%.[7] These factors, urbanization and changing lifestyles could be contributing to the rise in the disease as have been observed in this and similar studies.[18]

Conclusion

The study revealed that persons from high income households had an increased risk of getting diabetes as compared to those from low income households. Fasting glycaemia is strongly positively correlated with age and body mass index. Diabetic persons were at a higher risk of becoming hypertensive as compared to normotensive subjects. It is recommended that a nationwide study be done to assess the situation for policy makers to know the necessary resources required in addressing this menace. Further studies could look at the influence of genetic and environmental factors on the risk of becoming diabetic.

Acknowledgements

Authors express their appreciation to the study participants, Chief/elders, Nurses, Pharmacy Assistants, Laboratory Technicians, Teaching/Research Assistants from Prof. Matilda Steiner-Asiedu, Prof. Firibu Kwesi Saalia, Dr. William Bruce Owusu, Prof. Emmanuel Ohene Afoakwa , Dr. Agartha Ohemeng and Sixtus Aguree all of the Department of Nutrition and Food Science, University of Ghana for their kind support of this work.

Competing interests

The authors declare that they have no competing interest.

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Citation: Vuvor F. The association between socio-demographic status and the prevalence of diabetes mellitus in a deprived peri-urban population of Ghana. *J Diabetes Metab Disord Control.* 2016;3(6):129–133. DOI: 10.15406/jdmdc.2016.03.00084