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 18-45 years 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 and blood pressure (BP) were measured in the field using a glucometer and a sphygmomanometer after at least 15 minutes 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 ≥7.0 mmol/l and hypertensive if blood pressure (BP) was ≥140 mmHg (systolic).

Results: The mean age among subjects was 32.8 ± 7.4 years. 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

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. 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. However, direct association has been found between SES and diabetes prevalence in developing countries. Diabetes may be up to two times more prevalent in low income populations compared to wealthy populations. This relationship between SES and DM is stronger among women than men. 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. 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 15 minutes 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 ≥7.0 mmol/l and hypertensive if blood pressure (BP) was ≥140 mmHg (systolic).
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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/m²). 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 112 days. 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±7.4 years. 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 40-45 years 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 12 years 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 3.9 times 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.

Table 1 Socio-demographic characteristics of respondents by diabetes status

| Variable | Diabetic | Non-diabetic | P-value |
|----------|----------|--------------|---------|
| Age (years) | | | |
| 18-29 | 2(14.3) | 55(35.0) | 0.269 |
| 30-39 | 8(57.1) | 63(40.1) |      |
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| Variable                  | Diabetic (n=14) | Non-diabetic (n=157) | 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) |             |                      |         |
| High                      | 9 (64.7)        | 47 (29.9)            |         |
| Low                       | 5 (35.7)        | 110 (70.1)           | 0.009*  |
| Occupation: males         |                 |                      |         |
| 2 (14.3)                  | 12 (7.6)        | 145 (92.4)           | 0.583   |
| Self Employed             | 12 (85.7)       |                      |         |
| Occupation: females       |                 |                      |         |
| 1 (7.1)                   | 5 (3.2)         | 0.395                |         |
| Blue-collar job           | 13 (92.9)       | 152 (96.8)           |         |

Discussion
The mean age of respondents in this study was 32.8±7.4 years. 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. 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.

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                |      | Reference  |         |
| BMI (kg/m²)               |      |            |         |
| ≤25.0                     |      |            |         |
| ≥25.0                     |      |            |         |
| Systolic BP(mmHg)         |      |            |         |
| <140                      |      |            |         |
| 140-239                   |      |            |         |
| ≥230                      |      |            |         |
| Income                    |      |            |         |
| High                      | 3.9  | 1.1-14     | 0.038*  |
| Low                       |      | Reference  |         |

*Statistically significant P <0.05, OR, (Odds Ratio), Goodness- of- fit=0.954, R²=20.2%

Table 2 Blood pressure according to diabetes status of respondents

| Variable                  | Diabetic (n=14) | Non-diabetic (n=157) | P-value |
|---------------------------|-----------------|----------------------|---------|
| Mean±SD                   | 141.3±26.40     | 125.0±14.75          | 0.017*  |
| Diastolic BP(mmHg)        | 90.7±16.27      | 82.8±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                       |      | Reference  |         |

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The rising prevalence of diabetes in Ghana has been observed in several studies, 0.2% in the 1960s, 3.5% in the mid-1970s. In 2002 prevalence of 3.9% was recorded and, Amoah et al. reported a 6.4% prevalence in a community based study in Accra. 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 a major risk factor as compared to the rise from 29% in 1970; to 44% in 2000; to about 47%. These factors, urbanization and changing lifestyles could be contributing to the rise in the disease as have been observed in this and similar studies. 

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.

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