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ORIGINAL ARTICLE

Diabetes in the Cape Coast metropolis of Ghana: an assessment of risk factors, nutritional practices and lifestyle changes

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Background: Despite the significant increase in the incidence of diabetes in Ghana, research in this area has been lagging. The purpose of the study was to assess the risk factors associated with diabetes in the Cape Coast metropolis of Ghana, and to describe nutritional practices and efforts toward lifestyle change.

Methods: A convenient sample of 482 adults from the Cape Coast metropolis was surveyed using a self-reported questionnaire. The survey collected information on the demographic, socioeconomic characteristics, health status and routine nutritional practices of respondents. The aims of the study were addressed using multivariable regression analyses.

Results: A total of 8% of respondents reported that they had been diagnosed with diabetes. Older age and body weight were found to be independently associated with diabetes. Individuals living with diabetes were no more likely than those without diabetes to have taken active steps at reducing their weight.

Conclusion: The percentage of self-reported diabetes in this population was consistent with what has been reported in previous studies in Ghana. The findings from this study highlight the need for more patient education on physical activity and weight management.

Keywords: Cape Coast, Demographic and socioeconomic factors, Diabetes, Lifestyle changes, Nutritional practices

Introduction

According to the World Health Organization (WHO), worldwide diabetes prevalence was 108 million in 1980. By 2014, approximately 422 million individuals were reported to be affected by diabetes around the world.[1] It is estimated that approximately 80% of diabetes cases occur in developing countries.[2–4] The incidence of diabetes, as well as other chronic diseases, has increased significantly in the last few decades due to globalization and associated lifestyle changes. In a recent report, in 2015, 14.2 million Africans were found to be living with diabetes, and this number is expected to rise to 34.2 million by 2040.[5, pp. 70–1] The comparative percentage of type 1 and type 2 diabetes have not been examined in great detail for both low- and middle-income countries. However, in most countries, there has been a sharp rise in type 2 diabetes.[5, p. 51] Type 2 diabetes, hereafter referred to as diabetes, is a disorder that results in elevated blood sugar levels from insufficient insulin or a reduced responsiveness of cells to insulin action, while type 1 diabetes is an unpreventable, inflammatory disease of the islet of Langerhans, where insulin-producing beta cells are destroyed by auto-reactive T-cells and monocytic cells.[6]

Diabetes can result in several co-morbid conditions, including blindness, kidney failure, hypertension, necrosis of limbs, heart attack and stroke. Important risk factors for acquiring diabetes include obesity and physical inactivity. Additional factors contributing to the rise of diabetes incidence in Africa include genetic predisposition, environmental factors, diet, lifestyle and geographic residence (rural vs. urban).[7] Previous work has indicated that diabetes in Africa may be more prevalent among the wealthy, probably due to less physical activity and diets rich in saturated fats and refined sugar.[2]

In Ghana, the rate of diabetes is estimated to have risen sharply between 1956 and 2014.[8] Despite the significant increase in the incidence of diabetes, research in this area has been lagging, with only a few studies assessing the social and behavioral

factors associated with the development of diabetes. In one such study, Amoah and colleagues (2002)[9] estimated that the prevalence of diabetes, in a random sample of Greater Accra residents aged 25 years and above, to be 6.4%. The researchers found the risk factors for diabetes to include male gender, older age and body mass index. In contrast to other studies that have associated high socioeconomic status with increased burden of chronic illnesses,[10–11] Danquah *et al.* (2012)[11] found low socioeconomic status to be a risk factor for diabetes among urban residents in Ghana. None of these studies was conducted in the Central Region. Given that the factors associated with diabetes may vary based on geographical location, it is important to examine the region-specific factors that contribute to the development of diabetes in Ghana.

To this end, this exploratory study was conducted to add to the existing body of literature on diabetes within the Ghanaian context by identifying demographic and socioeconomic factors associated with self-reported diabetes; and examining differences in the nutritional practices, as well as lifestyle changes pursued among diabetics and non-diabetics.

Methods

Sample

The study participants were obtained by a convenient sampling of 482 adults, aged 18 years and older, from the Cape Coast metropolis in the Central Region of Ghana. To be included in the study, participants had to be residents of the Cape Coast metropolis, 18 years or older, and be willing to participate in the study. Researchers, together with trained assistants, recruited participants from the various suburbs of the Cape Coast metropolis by making announcements about the study at homes, churches, mosques, markets and other open public spaces in the city of Cape Coast and the surrounding villages/townships of Abora, Akotokyere, Amamoma, Amisano, Ankaful Village, Kakumdo, Ola and Pedu. Being very much conversant with the community, this kind of open invitation through direct engagement with our potential responders was adopted to get an optimum response rate. This strategy allowed the recruitment of individuals from different backgrounds and locations within the metropolis. Written informed consent was obtained from each participant who heard and understood the objective of the study, and who agreed to participate. The Institutional Review Boards (IRB) of Georgia Southern University (GSU)—I16167 and University of Cape Coast (UCC)—UCCIRB/EXT/2016/02 approved the study.

Survey

The survey was adapted from the Health and Nutrition section of the 2012 Health Information National Trends Survey (HINTS—Cycle 2) and reviewed by subject matter experts for its applicability to the Ghanaian context. The survey collected information on the demographic and socioeconomic characteristics of respondents. Participants reported whether or not they had previously been diagnosed with selected chronic conditions, including diabetes. Participants also reported their body weight, as well as their level of physical activity (how many days per week they engaged in moderate physical activity or exercise and for how many minutes per day). Information on routine nutritional practices, as well as lifestyle changes made within the last 12 months was also obtained. Routine nutritional practices assessed included the frequency of water intake, and soft drink (i.e. soda) intake, fruit and vegetable consumption, as well as fast food consumption. Respondents also reported whether they had made intentional lifestyle changes, including changes in physical activity, changes in fruit and vegetable intake and intentional efforts to alter body weight.

Based on sample size calculations, a sample of 383 participants was needed for a prevalence estimation precision rate of ±5% at a 95% confidence level. A total of 500 participants were recruited to account for non-response and 482 surveys were returned for a response rate of 96.4%.

Statistical analysis

Descriptive statistics, including frequencies, means and standard deviations were used to describe the study variables as appropriate. The demographic characteristics of the study sample were compared with that of the adult population in the Cape Coast metropolis using one-sample chi-square goodness of fit tests. The demographic information for the Cape Coast metropolis was obtained from the 2010 Ghana Census. A multivariable logistic regression model was used to examine demographic and socioeconomic factors associated with self-reported diabetes diagnosis. Socioeconomic and demographic characteristics assessed included gender, age, educational attainment, religion, marital status, geographic residence and employment. Self-reported body weight and duration of moderate physical activity (total minutes per week) were also included as control variables.

Non-parametric bivariate analyses, using Kruskal–Wallis and χ^2 tests, were used to assess the differences in nutritional practices and lifestyle changes between diabetics and non-diabetics, respectively. All analyses were performed using the Stata 14.0 statistical software. Statistical significance was assessed at the $p<0.05$ level.

Results

The majority of the survey respondents were female (246/468; 52.6%), under 40 years old (332/460; 72.2%), single (210/443; 47.4%), with at least a secondary school education (358/453;79.0%), and resident in the city (298/482; 61.8%). The ages of participants ranged from 18 years to 80 years with an average age of 34 years. Approximately half of the respondents were employed (231/464; 49.8%) (Table 1). The age and gender distribution of the study sample were statistically similar to that of the Cape Coast metropolis population. However, in comparison to the Cape Coast metropolis population, a higher proportion of the study sample lived in rural areas, and were more educated (Table 1).

Demographic and socioeconomic correlates of self-reported diabetes

The proportion of the study sample reporting to have been diagnosed with diabetes was 8.3%. In multivariable analysis, the only factors associated with self-reported diabetes were older age and body weight. Specifically, adults 50 years and older

Table 1. Demographic characteristics of respondents

Factor	n	Percentage	Cape Coast metropolis (%)	p-value
Gender				0.5843
Male	222	47.4	48.7	
Female	246	52.6	51.3	
Age				0.651
18–29 years	234	48.6	46.2	
30–39 years	98	20.3	20.3	
40–49 years	50	10.4	13.3	
50–59 years	47	9.8	9.3	
60+ years	31	6.7	11.0	
Location of residence				<0.001
City	298	61.8	76.4	
Other	184	38.2	23.3	
Education				<0.001
Lower than Secondary School	95	21.0	52.1	
Secondary School, Vocational, Technical, or Commercial training	175	38.6	19.0	
Post-secondary education, other than university	63	13.9	8.5	
College graduate or advanced degree	120	26.5	20.4	
Marital status				0.085
Married	172	38.8	29.8	
Living together, informal, or consensual union	12	2.7	4.9	
Widowed	14	3.2	4.2	
Divorced	12	2.7	3.9	
Separated	23	5.2	1.7	
Single	210	47.4	55.5	
Employment status				0.0334
Employed	231	49.8	54.7	
Other	233	50.2	45.3	
Self-reported diabetes				
Yes	37	8.3		
No	409	91.7		

were significantly more likely to have been diagnosed with diabetes, compared with those between the ages of 18 and 29 years (adults 50–59 years: Odds Ratio (OR)=6.23, 95% CI=1.42–27.45; adults 60+ years: OR=26.05, 95% CI=6.67–101.8). Similarly, body weight was found to be positively associated with a previous diagnosis of diabetes (OR=1.02, 95% CI=1.004–1.04). Females were twice as likely to report a diagnosis of diabetes, although this association was not statistically significant at the p<0.05 level (OR=2.28, 95% CI=0.92–5.67). None of the other demographic and socioeconomic factors were found to be associated with self-reported diabetes (Table 2).

Nutritional practices

In comparison with non-diabetics, diabetics reported drinking more cups of water daily, but fewer servings of soft drinks weekly. Specifically, over half of diabetics reported drinking no soft drinks, compared with only 9.1% of non-diabetics (p<0.001). On the other hand, almost nine out of ten diabetics (86.5%) reported drinking more than four cups of water daily, compared with about two-thirds (64.6%) of non-diabetics (p<0.01). Diabetics also consumed less fast food than non-diabetics, with almost half (47.2%) reporting no fast-food consumption, compared with 13.3% of non-diabetics. Daily fruit and vegetable consumption were found to be statistically similar between the two groups (Table 3).

Lifestyle changes

A lower proportion of diabetics, compared with non-diabetics had made intentional efforts to increase their level of physical activity in the past year (17.1% vs. 37.0%; p=0.063). This difference was not, however, statistically significant at the p<0.05 level. Compared with non-diabetics, a significant majority of diabetics reported that they had intentionally tried to maintain the amount of fruit intake in the past year (70.3% vs. 32.8%; p<0.001). Although a similar proportion of diabetics and non-diabetics reported intentionally trying to lose weight in the past year (22.2% vs. 21.9%), more diabetics reported that they had intentionally tried to maintain their weight (63.9% compared

Table 2. Factors associated with self-reported diabetes—multivariable logistic regression analysis

	Odds Ratio	SE	95% CI
Female (Ref: Male)	2.28	1.06	0.92–5.67
Age (Ref: 18–29 years)			
30–39	0.69	0.66	0.11–4.50
40–49	3.32	2.62	0.71–15.62
50–59	6.23*	4.71	1.42–27.45
60+	26.05***	18.12	6.67–101.84
Married or living with a partner (Ref: Other)	1.57	0.84	0.55–4.46
Resides in city (Ref: Other)	0.59	0.28	0.23–1.48
Education (Ref: University Graduate/Post Graduate Training)			
Lower than secondary school	0.71	0.43	0.22–2.31
Secondary school, vocational, or technical training	0.71	0.44	0.21–2.40
Post-secondary education	0.38	0.31	0.08–1.86
Employed (Ref: Other)	0.96	0.50	0.35–2.64
Body weight	1.02*	0.01	1.00–1.04
Duration of moderate physical activity (total minutes per week)	1.00	0.00	1.00–1.00

Table 3. Nutritional practices: diabetics and non-diabetics

	Diabetics n (%)	Non-diabetics n (%)	p-value
Number of bottles/cans of soft drinks (soda) drank per week			<0.001
None	21 (58.3)	37 (9.1)	
Less than 2	9 (25.0)	127 (31.3)	
2–4	6 (16.7)	154 (37.9)	
More than 4	0 (0.0)	88 (21.7)	
Cups of water drank per day			0.0065
None	0 (0.0)	0 (0.0)	
Less than 2	0 (0.0)	7 (1.7)	
2–4	5 (13.5)	138 (33.7)	
More than 4	32 (86.5)	264 (64.6)	
Cups of fruits or 100% fruit juice eaten or drank per day			0.6975
None	3 (8.1)	50 (12.4)	
Less than 2	27 (73.0)	241 (60.0)	
2–4	4 (10.8)	87 (21.6)	
More than 4	3 (8.1)	24 (6.0)	
Cups of vegetables or 100% vegetable juice eaten or drank per day			0.9857
None	2 (5.4)	44 (10.9)	
Less than 2	26 (70.3)	240 (59.6)	
2–4	6 (16.2)	89 (22.1)	
More than 4	3 (8.1)	30 (7.4)	
Fast food eaten per week			<0.001
None	17 (47.2)	54 (13.3)	
Less than 2	9 (25.0)	137 (33.7)	
2–4	7 (19.4)	130 (32.0)	
More than 4	3 (8.3)	85 (20.9)	

Table 4. Lifestyle changes in the past year: diabetics and non-diabetics

	Diabetics n (%)	Non-diabetics n (%)	p-value
Exercise			0.063
Intentionally tried to increase the amount of exercise taken in a typical week	6 (17.1)	149 (37.0)	
Intentionally tried to maintain the amount of exercise taken in a typical week	17 (48.6)	150 (37.2)	
Haven't really paid attention to the amount of exercise taken	12 (34.3)	104 (25.8)	
Diet—fruits			<0.001
Intentionally tried to increase the amount of fruit or 100% fruit juice eaten or drunk	5 (13.5)	151 (37.8)	
Intentionally tried to maintain the amount of fruit or 100% fruit juice eaten or drunk	26 (70.3)	131 (32.8)	
Haven't really paid attention to the amount of fruit or 100% fruit juice eaten or drunk each day	6 (16.2)	117 (29.3)	
Diet—vegetables			0.080
Intentionally tried to increase the amount of vegetables or 100% vegetable juice eaten or drunk	9 (26.5)	159 (40.0)	
Intentionally tried to maintain the amount of vegetables or 100% vegetable juice eaten or drunk	17 (50.0)	125 (31.4)	
Haven't really paid attention to the amount of vegetables or 100% vegetable juice eaten or drunk each day	8 (28.6)	114 (28.6)	
Weight loss			0.009
Intentionally tried to lose weight	8 (22.2)	88 (21.9)	
Intentionally tried to maintain weight	23 (63.9)	153 (38.1)	
Intentionally tried to gain weight	2 (5.6)	84 (20.9)	
Haven't really paid attention to weight	3 (8.3)	77 (19.2)	

with 38.1% of non-diabetics). No statistically significant differences were observed between the two groups as it pertained to changes in vegetable consumption (p=0.08) (Table 4).

Discussion

The purpose of this study was to identify the demographic and socioeconomic factors associated with self-reported diabetes among a convenient sample of residents of the Cape Coast metropolis in the Central Region of Ghana. The study also examined the nutritional practices and lifestyle changes among individuals with diabetes in comparison with those without the disease. The proportion of study participants with self-reported diabetes was 8.3%, which is consistent with previously reported estimates for Ghana.[9] Older age and body weight were significantly associated with self-reported diabetes, confirming similar findings from previous studies in Ghana and other parts of Africa.[9,11,12]

Rural residence, educational attainment, and employment status were not found to be associated with diabetes. The lack of an association between place of residence, in particular, departs from the findings from previous studies[13] that have reported an association between rural residence and decreased risk of diabetes in Africa. However, like this study, a previous study by Mbanya and colleagues (1997),[14] using an oral glucose tolerance test, did not find a relationship between rurality and self-reported diabetes. It is worth noting that the diabetes prevalence in some rural communities in Africa has been increasing at a rapid pace,[12] mainly due to the adoption of westernized behavior in many parts of Africa, including rural areas. Similarly, diabetes had previously been touted as a disease of the wealthy and elite in developing nations. However, this trend is reversing, mostly in part due to the increasing rate of urbanization, sedentary lifestyle and obesity rates, which have increased astronomically in rural, poor and less educated populations and even among children.[9,11,15–17]

We found no statistical difference in the amount of fruits and vegetables consumed by diabetics and non-diabetics. However, as expected the consumption of sugary drinks was lower among diabetics compared with non-diabetics. Water intake was also found to be greater among diabetics than non-diabetics, suggesting that diabetics may be substituting sugary beverages with water as recommended. Four out of ten diabetics reported drinking at least one soft drink per week, despite the fact that diabetic patients are advised to restrict their intake of sugary drinks. This finding may point to the need for additional education on proper nutritional practices for some patients with diabetes in this region.

The extant literature on diabetes has identified weight loss as an effective intervention for reducing the risk of diabetes, as well as managing the disease.[18] Weight loss, for example, has been shown to decrease the risk of mortality among diabetic patients.[19] In this study, however, diabetics were no more likely than non-diabetics to have taken active steps at reducing their weight. A lower proportion of diabetics, compared with non-diabetics also reported that they had intentionally increased their level of physical activity, although this association was only marginally significant. There is the need to develop, implement and promote sustainable, culturally appropriate, evidence-based weight loss interventions in Ghana. Such efforts could focus on health education relating to sound diet and physical activity, as well as

facilitating behavioral change. For African countries such as Ghana, less costly chronic disease management interventions, such as evidence-based educational and weight loss interventions may be beneficial and sustainable, given the existing health system financial and human resource constraints.[20–22]

There are some limitations of this study that are worth discussing. The study was exploratory in nature and utilized a non-probability sampling approach. Thus, the findings cannot be generalized beyond the study population. However, upon comparing the demographic characteristics of our sample with that of the Cape Coast metropolis, we found them to be statistically similar in terms of age and gender distribution. Also, diabetes was self-reported and non-verifiable. Thus, it is possible that some of the respondents who self-identified as non-diabetics could have been diabetics, thereby affecting our estimates, as well as the magnitude of the reported associations. Previous studies in Africa have found this to be true,[9] and evidence suggests that Africa harbors the greatest proportion (66.7%) of undiagnosed cases of diabetes compared with other regions of the globe.[5, pp. 70–3] Similarly, the assessment of nutritional practices and lifestyle changes were all based on self-reported data and may have been subject to recall bias. Due to a perceived expectation to provide socially desirable responses, participants, especially persons with diabetes, may have also under-reported their intake of fast foods and sugary beverages, thereby resulting in an overestimation of the effect of diabetes on the intake of these kinds of food and drinks. In addition, due to data limitations, this study may not have adjusted for all possible confounders. For example, the data did not include information on family history of diabetes. Family history is an important risk factor for diabetes and could have impacted the results. Finally, due to the cross-sectional study design, there may be an issue with reverse causation or simultaneity bias. The lack of physical activity, for example, may be a risk factor for diabetes, but may also be a consequence of the physical limitations posed by the disease.

Despite these limitations, the findings from this exploratory study add to our understanding of the distribution of diabetes in the Cape Coast metropolis, and highlight the need for more education on physical activity and weight management targeted at patients with diabetes. Additional research is needed to obtain generalizable estimates of the prevalence and distribution of the disease in the Central Region and to enhance our understanding of the predisposing factors for diabetes within this region.

Authors contributions: All the authors made significant intellectual, technical and acquisition of data towards the manuscript. BKB worked tirelessly to administer the surveys and recruited several volunteers to administer the surveys. SA led the Institutional Review Board (IRB) at the University of Cape Coast (UCC). WEG, SA, BAA and STO worked on the design and running of the experiments. All four contributed to the drafting and editing of the manuscript. Also, BAA and STO analyzed the data. WEG was the originator of the research concept. He collaborated with SA, BAA and STO to execute the project.

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Ethical Approval: With the submission of this manuscript the authors would like to affirm that the above-mentioned manuscript has not been published elsewhere, accepted for publication elsewhere or under editorial review for publication elsewhere; that all authors have contributed significantly and in keeping with the latest guidelines of the International Committee of Medical Journal Editors (author contribution outlined below); and that all authors are in agreement with the content of the manuscript and are aware of this submission. The manuscript is the original work of the authors. All data, tables, figures, etc., used in the manuscript were prepared originally by authors. Otherwise, the sources are cited. The Institutional Review Boards (IRB) of Georgia Southern University [GSU—I16167] and University of Cape Coast (UCC)—[UCCIRB/EXT/2016/02] approved the study.

Human subjects: The researchers recruited participants from the various suburbs of the Cape Coast metropolis by making announcements about the study at homes, churches, mosques, markets and other open public spaces. Written informed consent was obtained from each participant. Data was present as an aggregate and anonymized where applicable.

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