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PREVALENCE AND KNOWLEDGE OF TYPE 2 DIABETES MELLITUS AMONG ADULTS IN THE KETA MUNICIPALITY OF GHANA

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ABSTRACT

Type 2 Diabetes mellitus is a major cause of mortality globally with increasing prevalence annually. This study determined the prevalence of DM2 and assessed knowledge of the disease among adults in the Keta Municipality. **Method:** A community-based cross-sectional study which involved 264 adults 18 years and above was used. A semi-structured questionnaire was used to collect information through face-to-face interviews. Measurement of anthropometric indices and finger-prick blood samples collection for the determination of blood glucose level were done using standard methods. **Results:** Prevalence of diabetes including those on treatment was 6.4%. However, at the time of the survey, the prevalence was 3.4% and Pre-diabetes was 0.8%. Undiagnosed diabetes was 2.4% whilst the majority (72.7%) of respondents who were diabetic had their diabetes under control. Obesity and marital status were risk factors found to be associated with diabetes. In all, high, moderate and low knowledge of participants was 18.2% 36.4% and 45.4% respectively. Participants' high knowledge on causes, complications and prevention of diabetes was 17.8%, 28.4% and 33.3% respectively. There was a weak positive but significant correlation between age, BMI and knowledge on diabetes ($r=1.13$, $p=0.032$, $\alpha=0.05$) ($r=1.17$, $p=0.005$, $\alpha=0.05$) and ($r=1.15$, $p=0.014$, $\alpha=0.05$) respectively. **Conclusion:** Prevalence of diabetes, pre-diabetes and undiagnosed diabetes were relatively low compared to other studies. Adults with diabetes were able to control their blood glucose level. The overall knowledge on causes, complications and prevention of diabetes was low. There is the need for further studies involving larger sample size to determine the prevalence of diabetes among rural and urban adults and also establish associations between risk factors and diabetes in the Keta Municipality.

KEYWORDS: Type 2 diabetes, controlled diabetes, undiagnosed diabetes, awareness of diabetes, pre-diabetes, community-based, Keta Municipality, Ghana.

INTRODUCTION

Non-communicable diseases have become the leading causes of mortality and disease burden worldwide. The prevalence of diabetes mellitus (DM) continues to increase worldwide, with developing countries being the most affected.

Diabetes Mellitus is an endocrine disorder of carbohydrate metabolism in which sugars in the body are not oxidized to produce energy due to lack of pancreatic hormone insulin. Insulin produced by the pancreas goes into the bloodstream to help move the sugar from the bloodstream into the body cells where the sugar is used for energy. The accumulation of sugar in the blood leads to hyperglycemia and into urine with symptoms including thirst, loss of weight and excessive production of urine.[1]

The types of diabetes include type 1 diabetes mellitus (DM1), type 2 diabetes mellitus (DM2), and gestational diabetes. Type 1 is a condition in which pancreatic β-cell destruction usually leads to absolute insulin deficiency. It accounts for about 5–10% of all cases of diabetes. However, its incidence continues to increase worldwide and it has serious short-term and long-term implications. The onset of DM1 is usually during childhood or adolescent.[2]

Type 2 also known as adult-onset diabetes, occurs when impaired insulin effectiveness (insulin resistance) is accompanied by the failure to produce sufficient β-cell insulin. In DM2, the pancreas retains some ability to

produce insulin but this is inadequate for the body's need and alternatively, the body becomes resistant to the effects of insulin and patients are treated with oral hypoglycemic agents and insulin.[1] Worldwide, DM2 leads to high levels of morbidity and mortality and has a huge impact on individuals and national budgets and accounts for 95% of diabetes cases.

A blood sugar test is usually conducted to determine the presence of diabetes. This test is conducted using three methods; random blood sugar test, fasting blood sugar test and oral glucose tolerance test. Blood sugar values are expressed in milligrams per deciliter (mg/dL) or millimoles per liter (mmol/L). In the random blood sugar test, a blood sample is taken at a random time. Regardless of when you last ate, a random blood sugar level of 200 mg/dL (11.1 mmol/L) or higher suggests diabetes, especially when coupled with any signs and symptoms of diabetes thus; frequent urination and extreme thirst. In a fasting blood sugar test, a blood sample is taken after an overnight fast. A fasting blood sugar level less than 100 mg/dL (5.6 mmol/L) is normal. A fasting blood sugar level from 100 to 125 mg/dL (5.6 to 6.9 mmol/L) is considered pre-diabetes (impaired glucose tolerance). A fasting blood sugar level of 126 nm/dL (7 mmol/L) or higher on two separate tests suggests diabetes.[3]

Diabetes is a major risk factor for ischemic heart disease and stroke which collectively killed an estimated 12.9 million people globally in 2010. The most common form of diabetes is DM2 and can be controlled through healthy diet, physical activity, losing excess weight, and oral medication.[4]

The prevalence of DM2 is rising at an alarming rate throughout the world due to increases in life expectancy, obesity and sedentary lifestyles. Of particular cause for concern is the dramatic rise of DM2 in children and adolescents. The worldwide prevalence of diabetes is estimated to increase to 5.4% by 2025 and developing countries will be responsible for 75% of diabetics in 2025.[5,6] Globally, the number of adults with DM aged 20–79 years was estimated as 387 million (8.3%) in 2013.

Globally, people die as a result of DM. One of the increasing non-communicable diseases on the African continent with increasing associated deaths is DM2. According to Oputa and Chinenye, 14.7 million adults between the ages of 20 and 79 have diabetes in Africa.[7] This number indicates a prevalence of 4.5% among the adult population. The study reported that the highest cases of undiagnosed diabetes are recorded in Africa with 80% of adults being undiagnosed.

Sub-Saharan Africa (SSA) has the highest prevalence of diabetes in the Africa region. Thirty (30) of the 49 least developed countries as listed by the United Nations are in SSA. There is a 98% projection growth for SSA; thus from 12.1 million in 2010 to 23.9 million in 2030.[8] It was reported that mortality attributable to diabetes in SSA in 2010 was estimated at 6% of total mortality.

A study conducted in India revealed that 108(56.25%) out of 192 diabetic patients knew about diabetes. More than half 142 (73.93%) of the patients knew the impact of diabetes on other organs, 16(11.26%) indicated kidneys, 13(9.13%) mentioned heart and 45(31.69%) indicated that diabetes affects multiple organs and the majority 142 (73.95%) of patients had knowledge of complications.[5] Another cross-sectional study conducted in New Zealand revealed that respondents did not know that DM2 is an illness in which one has more than normal levels of sugar in the blood. Also about half (49%) of respondents either responded incorrectly or "neither agree nor disagree" with the statement "Type 2 diabetes is related to eating too many fats".[9]

The IDF estimates that 302,000 people had diabetes in Ghana in 2000 and this is estimated to increase to 851,000 by 2030. It is estimated that undiagnosed diabetes mellitus accounts for 70% diabetes. The global increase in diabetes is triggered by and associated with many factors, including the ageing population and unhealthy diets and sedentary lifestyles that heighten one's propensity towards obesity. Factors associated with DM2 can be non-modifiable (genetic factors, demographic determinants: such as age and ethnicity) and modifiable (behavioral and life style-related: such as obesity and physical inactivity, metabolic and intermediate risk).[6]

Knowledge of the disease will play a great role in the prevention and control of the disease. With proper education, awareness, earlier detection and better care, many complications can be reduced. Studies suggest that in many parts of the world, there is lack of public awareness and knowledge of various aspects related to diabetes.[5]

Diabetes is one of the most prevalent non-communicable diseases in Ghana with high numbers of associated deaths annually. A study conducted in Ghana stipulated that DM2 affects at least 6% of adults in urban Ghana.[10] A similar study conducted by Mbanya in Ghana showed urban prevalence of 6.4% in adults above the age of 25 years.[8] The study indicated that abdominal adiposity and increased body fat percentage also contribute significantly to diabetes. Other contributory factors include age, sex, and lack of formal education.[10]

Keta Municipal Health Directorate (KMHD) reports that 2,037 diabetic cases were identified in 2015 alone. Available data from the KMHD indicates that diabetes is the 3rd most prevalent non-communicable disease in the municipality. It accounted for an average of 6.48% of non-communicable diseases from 2013 to 2015. In 2013, 2,000 cases were recorded and this increased to 2112 in 2014 and reduced slightly to 2037 in 2014. It was

reported that diabetes was the 3rd most prevalent non-communicable disease in the municipality during this period; followed by anemia and hypertension.[11] However, it is observed that the people in the municipality do not practice healthy lifestyles. This could be due to the fact that the people lack knowledge on the causes of diabetes, limiting their ability to prevent it. This study, therefore, determined the prevalence of DM2 and assessed the knowledge regarding DM2 among adults in Keta Municipality.

MATERIALS AND METHODS

Study area

Keta Municipality is one of the twenty-five (25) administrative districts/municipalities in the Volta Region of Ghana with a total population of 162,942 people (projected from the 2010 census). It is located in the south-eastern part of the Volta estuary, between longitude 0°30E and 1°05E. The Municipality shares common borders with Akatsi South District to the North, the Gulf of Guinea to the South, South Tongu District to the West and Ketu South District to the East. The administrative capital of the municipality is Keta. It has a total land area of about 1,086km^2, out of which about a third is covered with water (362km^2). Among the water bodies, is the Keta lagoon which is the largest. The lagoon is about 1.2km wide and 32km long and is a designated wetland area. The remaining land area of 724 km^2 creates a situation of severe constraint on access to land for development in the Municipality. The Volta River passes through the western part of the Municipality at Galo-Sota and Anyanui before finally emptying itself into the sea at the estuary in Ada. There are six sub-municipalities namely; Keta, Tegbi, Anloga, Anyanui, Shime and Anyako. The municipality has one main ethnic group, the Anlo-Ewes. The municipality is endowed with 28 health facilities including 2 Hospitals, 12 health centres, 5 private clinics, 3 private maternity facilities, and 6 functional CHPS zones.

Study population

The population of the study comprised adults aged 18-64+ years residing in the municipality. Adults aged 18-64+ residing in the municipality and consented to participate were included. Adults not residing in the municipality, seriously ill or did not consent to participate were excluded from the study.

Study design

A community-based cross-sectional study design was used. A semi-structured questionnaire was used to collect information through interviews. Information collected included demographic characteristics, knowledge on causes, complications and prevention of DM2. There was a measurement of anthropometric indices (weight, height, waist and hip circumference). Finger-prick blood samples were collected for determination of fasting/random blood glucose level.

Sample size determination

The required sample size was determined using a sample size calculation formula.[15] Reliability coefficient (z) of 1.96 at 95% confidence level, the margin of error of 5% and prevalence of type 2 diabetes in adults as 8.7% (Nyarko, 2015 unpublished) were entered into the formula to determine a minimum sample size of 244.11 $\approx 244.$ However, a non-response rate of 8% was applied to the minimum sample size which was increased ≈ 264 to 263.52 adults.

Sampling method

The multistage sampling method was used. The six sub-municipalities were stratified into two groups; urban and rural. Two urban and two rural communities were randomly selected from each sub-municipality using simple random sampling technique (balloting). For each community, households were randomly selected. Within each study community, the central point was located. Standing at that location, the field worker spun a pointed object. The angle the object took determined the direction to follow. The field worker entered the first house facing him/her from which a respondent was sampled. Where there were more than one eligible households in a selected house, only one household was drawn at random and also only one eligible person in the household was randomly selected to represent all the eligible households' members. Where there were 4 or more eligible households in a house selected, two households were drawn at random and only one eligible person was randomly selected in each household. In a case where no eligible household was found in a selected house, the house whose entrance directly faces the one being exited from was the next compound visited. Thus, the serpentine movement approach aided field workers to identify subsequent houses and this procedure was repeated until the required number of respondents was obtained.

Data Collection

A pre-tested, semi-structured questionnaire was used to collect information on the socio-demographic characteristics and awareness about hypertension. Data was collected through one-on-one interview. Arterial blood pressure and anthropometric measurement of height, weight, hip and waist circumference were measured. Qualified health personnel were trained to assist in the data collection. Data quality control was ensured by calibrating all data collection tools for measurements before use.

Blood Pressure measurement

Arterial blood pressure was measured at rest using a digital sphygmomanometer MOTECH™®TrueScan™ (Digital/Automatic Blood Pressure Monitor, Germany). Repeated measurements were taken in triplicate at five minutes interval and the averages of the two nearest measurements recorded to the nearest 1mmHg.

Anthropometric measurements

Weight measurements were taken with an electronic bathroom weighing scales (Seca Personen wage Clara 803 Medical Scales and Measuring Systems, Hamburg, Germany). Weight was taken with participants wearing light clothing without shoes and values obtained were recorded to the nearest 0.5kg. Heights of the traders were taken with a Stadiometer while standing upright to the nearest 0.1cm. Waist Circumference (WC) and Hip Circumference (HC) were measured to the nearest 0.1cm using an inextensible tape measure and the measurements were done at the naval region for WC and at the level of the greater trochanter for HC.

Blood glucose level measurement

Capillary blood (10µl) from the participants was obtained after pricking the ethanol-cleaned fingertip with a sterile lancet and the blood obtained was used to determine their blood glucose level using a Glucometer (ONETOUCH UltraEasy bloodglucosemeter, UK). Fasting Blood Sugar (FBS) was obtained from the adults who observed an overnight fast, and those who had already eaten before the interview were visited the following day early in the morning after fasting where FBS was obtained. All measurements were recorded to the nearest 0.1 mmol/L. Aseptic techniques were ensured during and after the procedure to prevent infection.

Classification of Diabetes

Diabetes was classified based on recommended cut-offs (WHO, 2016) as follows:

Normal (FBG <6.0 mmol/dl); Pre-diabetic (FBG = 6.1-6.9 mmol/dl); Diabetic (FBG >=7.0 mmol/dl).

Classification of physical activity

Physical activity was estimated by quantifying activities such as carrying light loads, washing clothes, brisk walking to the farm or to the market, scrubbing the floor, sweeping inside or around the home. Physical activity was re-categorized as ≥3 days in a week and <3 days in a week.

Statistical analysis

Body mass index (BMI) was calculated based on WHO criteria as weight (kg) divided by height squared (m^2). Waist-to-Hip Ratio (WHR) was calculated by dividing WC by HC. BMI and WHR were classified based on WHO (1995) recommendations. FBS was classified based on WHO recommended cut-offs. Data was analyzed using SPSS version 20.0 (Chicago, USA). Frequencies and percentages were used to summarize categorical variables (sex, educational background, ethnicity, religion) whilst means and standard deviations were used for continuous variables (BMI, blood pressure and blood sugar level). Chi-square analysis was used to test for the association between diabetes and background characteristics. The dependent variable was diabetes with three levels: high blood sugar, intermediate and low blood sugar. Independent variables used in the multivariable logistic regression model were background characteristics such as age, sex, educational level, and marital. Other independent variables were ever been diagnosed DM2, Static/Sedentary business location (requiring sitting at one place or selling in shops, little activity) or mobile (walk approximately 3km per day or more to sell goods), time for supper, fruits and vegetables consumption and physical activity defined as any bodily movement produced by skeletal muscles that requires energy expenditure – including exercise, activities undertaken while working, playing, carrying out household chores, active transportation, travelling, and engaging in recreational activities. The statistical significance was set at p-value < 0.05.

Ethical Issues

Before commencement of the study, ethical approval was obtained from the Ministry of Health (MoH/ Ghana Health Service (GHS) Ethical Review Committee (MoH/GHS-ERC). Permission was sought from the Municipal Assembly and Municipal Health Directorate. Written informed consent was obtained from all respondents. Each respondent was informed prior to the interview that they were under no obligation to take part and that participation was voluntary. Therefore, they could withdraw at any time and that all responses would be treated with paramount confidentiality. All the adults who agreed to be part of the study signed an informed consent form before being interviewed and blood samples were taken.

RESULTS

Table 1 summarizes the demographic characteristics of the participants. A total of 264 participants were involved in the study out of which 192(72.7%) were females and 72(22.3%) were males. The mean age of participants was 52.5±16.4 years. The age group of 60+ years had the highest number of participants, thus 96(36.4%), followed by 40-49 45(17.1%) and 50-59 57(31.6%). Sixty-six (25.0%) participants were less than 40 years. Only 22(8.3%) of the participants attained the tertiary level of education. Seventy-three (73) (27.7%) of them never had any formal education whilst 45(17.0%) had up to primary level. Eighty-nine (89) (33.7%) and 35(13.3%) of them attained JHS and SHS level of education respectively. Most of the participants, 207(78.4%) were self-employed whilst 17(6.4%) were civil servants. Fifteen (5.7%) of the participants were retired and 25(9.5%) were unemployed. The majority of the participants, 150(56.8%) were married followed by 55(20.8%) who were widowed. Thirty-three (33) (12.5%) of them were single and 26(9.9%) were divorced. As many as 206(78.0%) of the participants were Christians whilst 50(19.0%) were Traditionalists and only 8(3.0%) of them were Muslims. One hundred and thirty-eight (52.7%) of them had monthly incomes less than 300 Ghana cedis and 126(47.7%) had a monthly income above 300 Ghana cedis.

Table 1: Demographic characteristics of participants.

Demographics	Frequency [n=264]	Percentage (%)
Age group		
<40	66	25.0
40-49	45	17.0
50-59	57	21.6
60+	96	36.4
Mean Age (SD)	52.5 (16.4)	
Sex		
Male	72	22.3
Female	192	72.7
Educational level		
None	73	27.7
Primary	45	17.0
JHS	89	33.7
SHS	35	13.3
Tertiary	22	8.3
Occupation		
Unemployed	25	9.5
Civil servant	17	6.4
Self employed	207	78.4
Retired	15	5.7
Marital Status		
Single	33	12.5
Married	150	56.8
Divorced	26	9.9
Widowed	55	20.8
Religion		
Christianity	206	78.0
Muslim	8	3.0
Traditionalist	50	19.0
Monthly income		
Less than 300	138	52.3
Above 300	126	47.7

Prevalence and Classification of diabetes status of participants

Figure 1 shows the classification of diabetes among the participants. A total of 9 (3.4%) participants were diabetic and 2 (0.8%) were pre-diabetic. The rest 253 (96.4%) were unaware of their diabetes status (Table 3). Table 3 shows that out of the 11 respondents who had been diagnosed diabetic, 3 (27.3%) could not control their blood sugar levels whilst 8 (72.7%) had their blood sugar under control. Of the 253 respondents who were not aware of their diabetes status, 6 (2.4%) had high FBS at the time (undiagnosed diabetes). The overall prevalence of diabetes including those on treatment and had it under control was therefore 17 (6.4%).

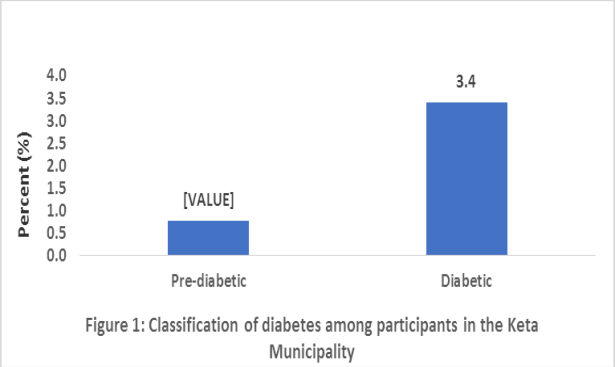

Figure 1: Classification of diabetes among participants in the Keta Municipality

Association between participants' demographic characteristics and diabetes

Table 2 shows the association between participant's demographic characteristics and diabetes. There was no significant association between sex and diabetes (χ^2 = 1.23, p=0.268 α=0.05). There was also no significant association between age, ethnicity and diabetes (χ^2 = 7.12, p=0.068 α=0.05) and (χ^2 = 0.11, p=0.948 α=0.05) respectively. There was no association between religion and diabetes (χ^2 = 0.73, p=0.696 α=0.05). There was, however, a significant association between marital status and diabetes (χ^2 =7.99, p=0.046 α=0.05). There was no association between educational level, occupation and diabetes, (χ^2 = 8.98, p=0.062 α=0.05) and (χ^2 = 5.55, p=0.119 α=0.05) respectively. There was no significant association between monthly income and diabetes (χ^2 = 0.04, p=0.08 α=0.841) (Table 3).

Table 2: Association between Demographic characteristics and Diabetes status.

Demographic factors	Normal [n=255] n (%)	Diabetic [n=9] n (%)	Total [N=264] N (%)	χ^2	p-value
Sex					
Male	71(27.8)	1(11.1)	72(27.3)	1.23	0.268
Female	184(72.2)	8(88.9)	192(72.7)		
Age					
<40	66(25.8)	0(0.00)	66(25.0)	7.12	0.068
40-49	45(17.6)	0(0.00)	45(17.0)		
50-59	53(21.0)	4(44.3)	57(21.6)		
60+	91(35.6)	5(55.7)	96(36.4)		
Ethnicity					
Ewe	252(98.8)	9(100.0)	261(98.9)	0.11	0.948
Akan	1(0.4)	0(0.0)	1(0.4)		
Northern	2(0.8)	0(0.0)	2(0.7)		
Religion					
Christianity	198(77.7)	8(88.9)	206(78.0)	0.73	0.696
Muslim	8(3.1)	0(0.0)	8(3.0)		
Traditionalist	49(19.2)	1(11.1)	50(19.0)		
Marital status					
Single	33(13.0)	0(0.00)	33(12.5)	7.99	0.046
Married	147(57.6)	3(33.3)	150(56.8)		
Divorced	23(9.0)	3(33.3)	26(9.9)		
Widowed	52(20.4)	3(33.3)	55(20.8)		
Educational level					
None	71(27.8)	2(22.2)	73(27.7)	8.98	0.062
Primary	45(17.7)	0(0.0)	45(17.0)		
JHS	87(34.1)	2(22.2)	89(33.7)		
SHS	31(12.2)	4(44.4)	35(13.3)		
Tertiary	21(8.2)	1(11.1)	22(8.3)		
Occupation					
Unemployed	25(9.8)	0(0.0)	25(9.5)	5.85	0.119
Civil servant	16(6.3)	1(1.1)	17(6.4)		
Self employed	201(78.8)	6(66.7)	207(78.4)		
Retired	13(5.1)	2(22.2)	15(5.7)		
Monthly income					
Less than 300	133(52.2)	5(55.6)	138(52.3)	0.04	0.841
Above 300	122(47.8)	44(44.4)	126(47.7)		

Association between awareness and diabetes

Table 3 shows that there was a significant association between awareness of diabetes status and diabetes (χ^2 = 21.05, p<0.001, α=0.05). A total of 11(4.2%) respondents were aware or have been diagnosed diabetic. However, at the time of the survey, 9 respondents had high FBS level of which 3(33.3%) were aware and 6 (66.7%) were not aware.

Association between participants' BMI, Waist-to-Hip ratio and diabetes

Table 3 presents the association between anthropometric measurements and diabetes. There was a significant association between BMI and diabetes (χ^2 = 14.40, p=0.002 α=0.05). There was no significant association between waist-to-hip ratio for men and diabetes (χ^2 = 0.22, p=0.894 α=0.05). There was no significant association between waist-to-hip ratio for women and diabetes (χ^2 = 3.25, p=0.197 α=0.05). There was also no significant association between waist-to-hip ratio and diabetes for both males and females (χ^2 = 2.88, p=0.238 α=0.05).

Association between participants' physical activity and diabetes

Table 3 shows the association between physical activity and diabetes. There was no significant association between vigorous physical activity, moderate physical activity and diabetes (χ^2 = 2.51, p=0.474 α=0.05) and (χ^2 = 1.28, p=0.733 α=0.05) respectively.

Table 3: Association between Awareness, Anthropometric measurements, Physical activity and Diabetes status.

Characteristics	Normal [n=255] N (%)	Diabetic [n=9] N (%)	Total [N=264] N (%)	χ^2	p-value
Awareness					
No	247 (96.9)	6 (66.7)	253 (95.8)		
Yes	8 (3.2)	3 (33.3)	11(4.2)	21.05	<0.001
BMI					
Underweight	7(2.8)	0(0.0)	7(2.6)	14.40	0.002
Normal	100(39.2)	1(11.1)	101(38.3)		
Overweight	73(28.6)	0(0.0)	73(27.7)		
Obese	75(29.4)	8(88.9)	83(31.4)		
WHR MEN					
Low risk	58(81.7)	1(100.0)	59(81.9)	0.22	0.894
Moderate risk	11(15.5)	0(0.0)	11(15.3)		
High risk	2(2.8)	0(0.0)	2(2.8)		
WHR WOMEN					
Low risk	23(12.5)	1(12.5)	24(12.5)	3.25	0.197
Moderate risk	42(22.8)	4(50.0)	46(24.0)		
High risk	119(64.7)	3(37.5)	122(63.5)		
WHR ALL					
Low risk	81(31.7)	2(22.2)	83(31.4)	2.88	0.238
Moderate risk	53(20.8)	4(44.5)	57(21.6)		
High risk	121(47.5)	3(33.3)	124(47.0)		
Vigorous physical activity					
No physical activity	199(78.0)	9(100.0)	208(78.8)	2.51	0.474
1 day	8(3.1)	0(0.0)	8(3.0)		
2-3 days	16(6.3)	0(0.0)	16(6.1)		
>3 days	32(12.6)	0(0.0)	32(12.1)		
Moderate physical activity					
No physical activity	1(0.4)	0(0.0)	1(0.4)	1.28	0.733
1 day	28(11.0)	0(0.0)	28(10.6)		
2-3 days	62(24.3)	2(22.2)	64(24.2)		
>3 days	164(64.3)	7(77.8)	171(64.8)		

Correlation between age, BMI, Waist-to-Hip ratio, knowledge on diabetes and Blood sugar level

Table 4 shows that there was a weak positive but significant correlation between Age, BMI and knowledge on diabetes and diabetes (r=1.13, p=0.032, α=0.05), (r=1.17, p=0.005, α=0.05) and (r=1.15, p=0.014, α=0.05) respectively. There was no correlation between waist-to-hip ratio and diabetes (r= -0.02, p=0.754, α=0.05).

Table 4: Correlation between Age, BMI, Waist-to-Hip ratio, Knowledge on diabetes and Blood sugar level.

Variable	Blood sugar Level	
	r	p-value
Age	0.13	0.032*
BMI	0.17	0.005*
WHR	-0.02	0.754
Knowledge on Diabetes	0.15	0.014*

Knowledge on the causes, complications and prevention of diabetes

Figure 2 presents the knowledge of participants on the causes, complications and prevention of diabetes. A participant who answered 2 or less questions correctly on causes was classified as low knowledge and those that answered 3 or more questions correctly were classified as high knowledge. Out of a total of 264 participants, the majority (82.2%) had low knowledge on the causes of diabetes. Only 17.8% had high knowledge on the causes of diabetes. A participant who answered 4 or less questions correctly on complications was classified as low knowledge and those that answered 5 or more questions correctly were classified as high knowledge. The majority (71.6%) of the participants had low knowledge whilst 28.4% had high knowledge on the complications of diabetes. A participant who answered 3 or fewer questions correctly on prevention was classified as low knowledge and those that answered 4 or more questions correctly were classified as high knowledge. In all, 66.7% had low knowledge on prevention of diabetes whilst 33.3% had high knowledge on prevention of diabetes (Figure 2).

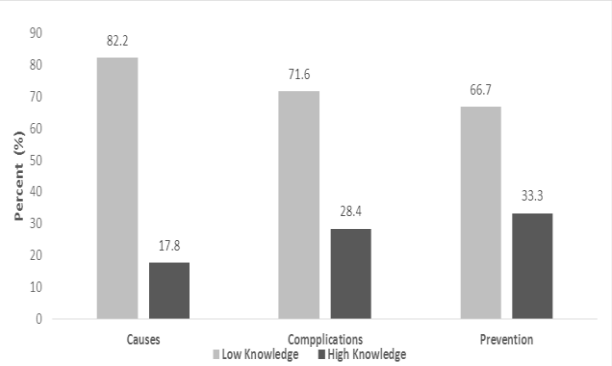

Figure 2. Participants knowledge on causes, complications and prevention of diabetes

Classification of Knowledge

Figure 3 presents the classification of participants' knowledge of diabetes. A participant who answered 6 or less questions correctly was classified as low knowledge. Those that answered 7 to 13 questions correctly were classified as moderate knowledge, and those that answered 14 or more questions correctly were classified as high knowledge. Out of the 264 participants in the study, 45.4% had low knowledge on the causes, complications and prevention of diabetes, 36.4% had moderate knowledge, and the rest (18.2%) had high knowledge (Figure 3).

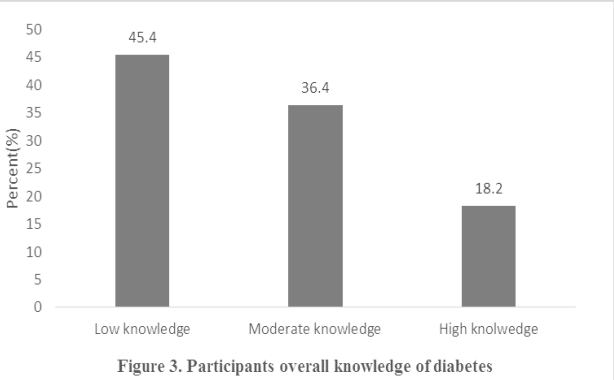

Figure 3. Participants overall knowledge of diabetes

DISCUSSIONS

Diabetes prevalence is increasing annually with developing countries being the most affected. This current study found a prevalence of 3.4% of DM2 among adults in the Keta municipality. Urban and rural prevalence of DM2 from the study were 3.0% and 3.8% respectively. The overall prevalence of type 2 diabetes in the municipality including those on treatment was 6.4%. The study further found that 11(4.2%) of the participants were aware that they had diabetes with only 3(33.3%) of them unable to control it. This is in agreement with a study conducted by Danquah et al. (2012)[10] in Ghana who reported a prevalence of 4.0%. This was however in contrast with findings from Hohoe,[13] which reported a prevalence of 8.7% and an overall prevalence of 10.3% among the participants including those on treatment. It was also found in the Hohoe study that only 3.2% of the participants were aware that they were diabetic with only half (1.6%) unable to control it.[13] It is possible that the prevalence of diabetes in Hohoe was higher because participants involved only traders in the municipality whilst participants in this study involved adults in the entire municipality. The results of this study contradicted others,[14] which reported the urban and rural prevalence of 6.9% and 5.6% respectively. Another important point of the current study was that the proportion of undiagnosed DM2 was higher in urban than in rural areas (75.0% and 60.0%). These findings are in contrast with findings from Qingdao, which reported a significantly higher proportion of previously undiagnosed DM2 in rural than in urban areas (70.5% and 58.0%).[14]

The current study found that DM2 predominantly affected obese people. Marital status was another factor associated with DM2. Age, sex, ethnicity, income, waist-to-hip ratio, and physical activity were not associated with DM2. The current study also reported DM2 to be associated with ethnicity. Another study conducted in England suggested that, in addition to overweight and obesity, risk factors for developing DM2 include increasing age, lifestyle factors such as physical inactivity, unhealthy diet, a family history of DM2 and a history of gestational diabetes or polycystic ovarian syndrome.[15] People from lower socioeconomic groups are particularly at risk.[15]

The current study found that 17.8% of participants had adequate knowledge on the causes of DM2, while the rest, 82.2% had low knowledge. This shows relatively low knowledge on causes of diabetes compared to other studies. A study conducted in New Zealand revealed that about half (49%) of the respondents did not know the causes of DM2.[9] Another study conducted in Saudi Arabia reported that only 53.3% of participants had adequate knowledge on the causes of DM2.[16]

About 28.4% of the participants in the current study had sufficient knowledge on the complications of DM2. A study conducted in Chennai found an even lower knowledge of participants on complications of DM2, which revealed that 19% knew that DM2 could cause complications.[17] Other studies, however, showed a higher percentage of participants with sufficient knowledge on complications. A study in India revealed that majority (82.6%) of the participants had knowledge of complications of diabetes.[5] Another study in Omani revealed that 55.1% of the participants knew about complications of diabetes.[6]

The current study revealed that only 33.3% of the participants had adequate knowledge on prevention of diabetes. A similar study in Chennai reported that only 22.2% of participants were aware that diabetes could be prevented.[17]

CONCLUSIONS

The overall prevalence of DM2 including those on treatment was 6.4% in the Municipality. However, at the time of the survey, the prevalence of DM2 was 3.4%

which is relatively low compared to other studies. This is because the majority of adults (72.7%) with DM2 were able to control their blood glucose level. Undiagnosed diabetes was 2.4%, which is also relatively low. Marital status and obesity were the most important factors associated with an increase in DM2 prevalence. The overall knowledge on causes, complications and prevention of diabetes was low.

RECOMMENDATIONS

There is the need for further studies in the municipality involving larger sample size to investigate the prevalence of DM2 among rural and urban adults and also establish an association between risk factors and DM2. In order to maintain the low level of DM2 in the Municipality, there is the need to institute diabetes prevention programmes such as intensive education and community-based screening to identify high-risk groups for counseling and referral for management in Keta Municipality.

ABBREVIATIONS

OPD- Out Patient Department, NCDs- Non-Communicable Diseases, GHS-Ghana Health Service, PI-Principal Investigator, RCH-Reproductive and Child Health, WHO-World Health Organization, BMI-Body Mass Index, Type 2 Diabetes Mellitus- DM2, CHPS-Community Health Planning and Services, CI-Confidence Interval, FBS-Fasting Blood Sugar, Lower Middle Income countries-LMIC, WC-Waist Circumference, HC-Hip Circumference, WHR-Waist-Hip Ratio, SPSS-Statistical Package for the Social Sciences, KMHD-Keta Municipal Health Directorate, GHS-ERC - Ghana Health Service- Ethical Review Committee.

DECLARATIONS

Ethics and consent statement

Ethical clearance was obtained from the Ghana Health Service Ethical Review Committee (GHS-ERC) with the approval identity (GHS-ERC: /10/16). Permission was also sought from the Municipal Health Directorate and the Municipal Assembly. Moreover, the traders themselves consented to be part of the study.

Availability of data and material

Available upon request

Competing interests

The authors declare that they have no competing interests

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AUTHORS' CONTRIBUTIONS

RA and MK conceived the study, RA, MK, MA, WT, WKA and RO did the data analysis and wrote the methods section. RA, MK, MA, WT, MT and ET were responsible for the initial draft of the manuscript. All authors reviewed and approved the final version of the manuscript.

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