Prevalence study of type 2 diabetes mellitus in the Ashanti region of Ghana: a systematic review of risk factors

Daniel Katey[a,*] , Abigail Akua Addo[b], Kabila Abass[a] and Anthony Kwame Morgan[a]

[a]Department of Geography and Rural Development, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana
[b]School of Nursing and Midwifery, University of Health and Allied Sciences, Ho, Ghana
*Correspondence: danielkatey50@gmail.com

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Introduction: The prevalence and risk factors of type 2 diabetes vary across the urban and rural milieus of Ghana's Ashanti Region, yet no study has been conducted to synthesise the available studies.
Methods: A comprehensive literature search was carried out in PubMed, CINAHL, Scopus and Web of Science with hand searches in Google Scholar and grey literature between May 15, 2021 and June 30, 2021. Searches were made for articles published between January 1, 2011 and December 31, 2020 on type 2 diabetes mellitus in the Ashanti region of Ghana. MeSH terms and keywords, separated by some Boolean operators, were used.
Results: The searches yielded a total of 268 articles, of which 12 studies were selected for the final review. Physical inactivity and obesity were identified as the major risk factors of type 2 diabetes in the region. Higher prevalence of the disease was also identified in females. More so, in terms of rural and urban divides, type 2 diabetes mellitus was found predominantly among urban dwellers.
Conclusion: Findings from the study call for mass sensitisation and awareness creation in respect of diabetes, to ensure that people are well informed on the dynamics of the disease in the region and, by extension, the country at large.

Keywords: Ashanti region, diabetes mellitus, prevalence, risk factors, systematic review, type 2 diabetes

Introduction

Diabetes remains one of the most prominent diseases of public health concern in the twenty-first century. According to the International Diabetes Federation (IDF),[1] 1 in every 11 people worldwide, the equivalent of about 463 million people globally, suffers from the disease. Similarly, the World Health Organization (WHO)[2] also indicates that, globally, diabetes has claimed over 4.2 million lives since the beginning of the twenty-first century. For the year 2019, the IDF[1] reports that over US$ 760 billion has been committed to combating diabetes globally. Despite this attempt, the WHO[2] noted that over 374 million more people presently are at high risk of developing complications related to diabetes. In the same way, the IDF[1] projected that, by end of 2045, over 700 million people across the world are likely to be suffering from the disease due to changing psychosocial and institutional factors. These recent developments have resulted in diabetes being listed as one of the top four non-communicable diseases of the twenty-first century.[1]

Being the most common type of diabetes, type 2 diabetes mellitus currently accounts for over 90% of all diabetes cases worldwide.[3–5] Though commonly associated with ageing and older adults, the disease is gradually becoming pervasive among young adults and adolescents,[5,6] which, according to Aranda[7] and Arnett *et al.*,[8] is as a result of physical inactivity, poor eating habits and obesity. Even though the health disorder is a global phenomenon, Thomas *et al.*[9] noted that it is gradually becoming predominant in developing countries, particularly those in Africa and Asia. According to the IDF,[1] China has the largest type 2 diabetes population in the world at about 120 million people.

Type 2 diabetes cases in Africa have not been different from the global picture.[3] With a prevalence rate of 3.9%, the IDF[10] report indicates that an estimated 19.4 million adults are living with the disease in the region, which according to the IDF[1] is likely to increase to 45 million by end of 2045. Similarly, the WHO[2] reported that about 45 million adults in Africa between the ages of 20 and 79 years have impaired glucose tolerance, which predisposes them to a high risk of developing type 2 diabetes in the near future. This figure has been estimated to rise to 110 million by 2045 if the necessary interventions are delayed.[2] Given that, in 2019, only US$ 9 billion was allocated to combating the disease on the African continent (which is equivalent to just 1% of the total health expenditure for the 2019 financial year), the scientific community foresees a gloomy future for the disease in Africa.[4,11–13] It has therefore become imperative that unprecedented actions are taken by member countries and the international community, to ensure that the continent is freed from the burden of this deadly disease. According to the IDF,[5] a victory over the surge of type 2 diabetes on the African continent will be a great milestone towards achieving sustainable development goal (SDG) 3 by end-of-year 2030. As a result, some member countries in Africa have in recent times committed a substantial proportion of health budgets to combating the disease within their geopolitical boundaries.[3,14–16]

Type 2 diabetes has a long history in Ghana. However, very little was known about the disease in that country until the latter part of the twentieth century.[17,18] In their nationwide study on the disease, Amoah *et al.*[17] found a generally held misconception that diabetes is a disease of the rich. This, according to Aikins *et al.*,[19] restrained all locally targeted actions to mitigate the disease in the past. Conversely, the advent of the Millennium Development Goals (2000–2015) and the Sustainable Development Goals (2015–2030) by the United Nations Organization (UNO), brought a rebirth of knowledge on the menace of type

2 diabetes at national, regional and district levels in Ghana.[17,19,20]

The literature contains copiously advanced knowledge on diabetes in the Ashanti region of Ghana. This region currently has the highest level of scientific writing on type 2 diabetes in the country.[21–24] For instance, Addo *et al.*[25] found that diabetes prevalence increases with increasing level of education in urban Kumasi. In the same regard, Agbogli *et al.*[26] found sedentary lifestyle activities, overweight and obesity to be major risk factors for diabetes in the Oforikrom Municipality. Psychosocial risk factors (lifestyle and behavioural) such as physical inactivity, unhealthy dietary practices, over-consumption of alcohol, unhealthy food intake, overeating, smoking and eating late at night have also been established by Aikins *et al.*[19] as the major cause of type 2 diabetes mellitus in the region. However, as far as this study is concerned, no single scholarly work exists in the study area, which synthesised all primary research on type 2 diabetes mellitus to ascertain the most prevalent risk factors of the disease. The relevance of knowledge synthesis in any given subject area cannot be underestimated. According to Wohlin,[27] systematic reviews help to identify, evaluate and summarise the findings of all relevant individual studies on a health-related issue, thereby making the available evidence more accessible to decision-makers. Against this background, this study seeks to fill this crucial research gap by ascertaining and examining the disease prevalence and the most common risk factors of type 2 diabetes mellitus in the Ashanti region of Ghana.

Methods

The generally accepted Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) was followed as a guide for conducting the study.

Literature search

A rigorous literature search was carried out in four well-known bibliographic databases (Figure 1). These were Web of Science, Scopus, Medline (PubMed) and CINAHL. Hand searches were also done in Google Scholar and the grey literature (theses) for relevant supplementary material. Searches were conducted for articles published from January 1, 2011 to December 31, 2020 on type 2 diabetes mellitus in the Ashanti region of Ghana. This timeframe was chosen because much research was found to have been conducted on the subject matter within the period, thereby making the issue shoot into the limelight in Ghana. Reference lists of some downloaded articles were consulted to identify other relevant articles. Key words and medical subject headings (MeSH) terms were used for the searches in the above-listed bibliographic databases. Boolean operators ('AND' and 'OR') were used to separate MeSH terms and keywords. Based on the objective of the study, the following MeSH terms were used: 'Diabetes mellitus', 'Type 2 diabetes', 'Diabetes mellitus, type 2', 'Risk factors' and 'Prevalence'. The key words included 'type 2 diabetes', 'type II diabetes', 'T2D', 'T2DM', 'DM2', 'diabetes mellitus', 'prevalence', 'risk factors' and 'Ashanti region'. The searches focused on articles published on adult diabetes patients (18 years and above). This was because, in Ghana, one is considered an adult when he/she is above 18 years of age.[28] Searches were also narrowed to articles published only in English for two key reasons. First, because English is the official language in Ghana and, second, due to financial constraints coupled with the difficulty of accessing the services of language translators.

Authors and experts who have over the years contributed significantly to the literature on diabetes were contacted to inquire about any additional published and unpublished materials. The searches started on May 15, 2021 and were completed on June 30, 2021.

Study selection and quality assessment

After downloading all necessary articles, the study employed the United States Preventive Services Task Force Procedure (USPSTF) manual to determine whether the articles were relevant to meet the overriding objective of the study.[29] In this regard, a multi-stage screening procedure was adopted to minimise errors, to enhance transparency of outcomes and, above all, to make the study producible. Two reviewers reviewed all the articles at all stages. First and foremost, the reviewers read through the titles and abstracts of all retrieved articles for relevance by broadly applying the inclusion criteria. In the event of uncertainties as to whether an article should be included, the reviewers erred strictly on the side of the inclusion criteria. The decision to either include or exclude such articles was made after agreements were reached between the two independent reviewers.

The final screening process commenced when all included articles were established. The two reviewers independently screened the full-text articles for further relevance based on studies' population, exposure/risk and outcomes (PEO).[30] Articles were further excluded, with reasons, where the main text failed to provide relevant information to achieve the objective of the study. Potential articles to be included in the study were assigned a mutually agreed unique code, to facilitate further assessment.

Data extraction

A standardised form was generated for the study using some generic items and relevant information unique to the study. Details on the form included: author(s) name(s), year of publication, characteristics of respondents, sampling technique, study area, and findings/results of the studies. The two independent reviewers sifted this information concurrently. Differences in opinions regarding some risk factors were resolved by agreement. Finally, to ensure validity and reliability of the instrument, the form was pre-tested on three different studies before adopting it for data extraction.

Setting

The Ashanti Region is the third largest of the 16 regions in Ghana. With a total land surface area of 24,389 km^2, the region occupies about 10% of the total land surface area of the country.[31] Even though the region has the largest population among the other regions, Kumasi, which is its capital, accounts for nearly one-third of the region's population. The region has a population density of 148.1 persons per square kilometre.[31] In terms of vegetation, it is located in the moist semi-deciduous forest belt. However, due to the rapid rate of urbanisation, climate change and bush burning, the north-eastern part of the region has been reduced to guinea savanna.[31] Due to the region's abundant mineral and agricultural resources, coupled with its strategic geographical location (between longitude 0.15W and 2.25W, and latitude 5.50N and 7.46N) and spatial interaction with other regions, it is largely referred to as the business hub of the country.[32]

Despite its population density, Katey *et al.*[33] and Ashiagbor *et al.*[34] found that access to health facilities is one of the major problems facing its people. However, access to primary
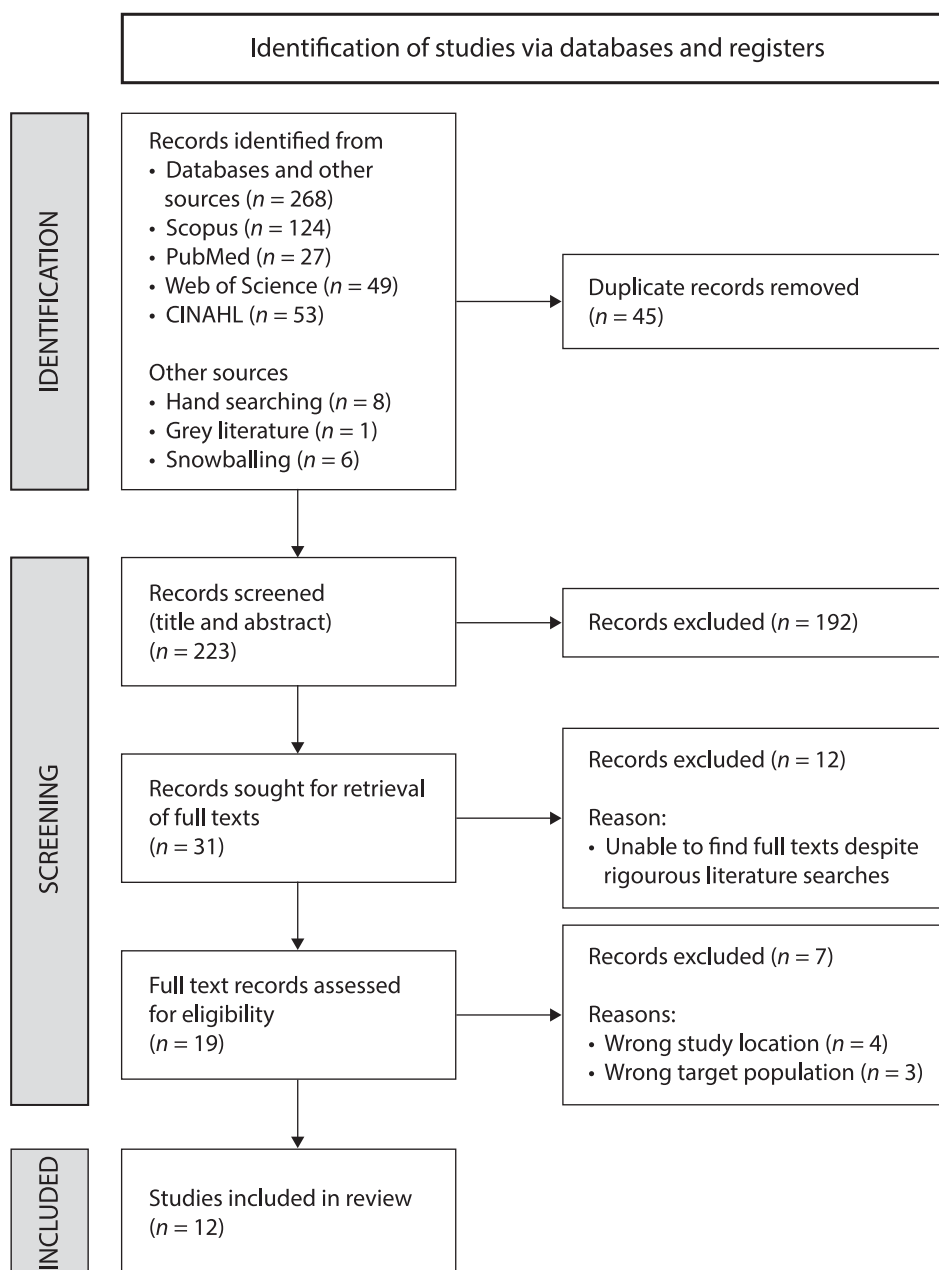
Figure 1: Flowchart of all synthesised literature.

health care facilities has been judged as very efficient. Information on the levels of educational attainment and literacy show that between 40.0% and 50.0% of the population in the region, particularly females, either have no formal education or have only pre-school education.[34] The proportion of the population with basic education varies from 67.7% in the Kumasi metropolis to 86.9% in the Amansie West District.[31]

Results

Literature search

Literature searches carried out in the four bibliographic databases produced a total of 253 results (PubMed = 27; CINAHL = 53; Scopus = 124; Web of Science = 49). A total of 15 articles were also retrieved through snowballing (= 6); hand searching (= 8); and grey literature (= 1). Therefore, in all, a total of 268 articles were retrieved. Of these, 45 were identified as duplicates and hence were excluded, leaving a total of 223 articles for the

first phase of the screening process (screening for title and abstract relevance). At this stage, a total of 192 reports were also excluded as neither their titles nor abstracts contained any useful information as far as the objective of the study was concerned, leaving 31 articles for further screening. The next phase of the screening process commenced with the downloading and screening of the 31 full-text articles. After a series of attempts, including emailing authors for full-text articles as well as using Find@UNC online literature search platform, 19 full-text articles were retrieved and assessed for eligibility. At the end of the screening process, 12 articles met all the inclusion criteria and thus were included in the final analysis.

Summary of included articles

Of the 12 articles, 10 employed probability sampling techniques (7 simple random, 3 multistage stratified) while 2 employed a convenient sampling method (see Table 1 for details). Three of the studies were nationwide surveys[35–37] while the remaining 9 were all study-area specific. The minimum age of respondents

Table 1: Summary of findings of studies included in the review to examine the risk factors of type 2 diabetes mellitus among adult Ghanaians in the Ashanti region of Ghana

Article/ Author	Characteristics of respondents	Sampling technique	Study area/location	Result
Addo i.[25]	A total of 5 290 adults aged between 25 and 70 living in Europe and Ghana	Random sampling	Both rural and urban residents of Kumasi	Diabetes prevalence increased with increasing level of education in urban areas In rural Ghana, the prevalence of diabetes was higher in men and women with a higher level of education
Agbogli et al.[26]	The study involved a total of 113 participants	Random sampling	Oforikrom Sub- Metro	Sedentary lifestyle activities, overweight and obesity were major risk factors fo diabetes Diabetes prevalence was similar in both males and females.
Aikins et al.[19]	Data were gathered through 26 focus-group discussions with 180 individuals, aged 21–70	Simple random	Asuoyeboah, Atonsu, Obuasi, Denyase, and Akwaaduo	Diabetes prevalence was perceived as a natural/supernatural phenomenon (family history of diabetes); overweight and natural fatness [obesity]; witchcraft and sorcery (bought for people) Psychosocial factors (lifestyle and behavioural) such as physical inactivity; unhealthy dietary practices; over-consumption of alcohol; unhealthy foods; overeating; smoking; eating late at night were also established as causes of type 2 diabetes mellitus Structural causes: Medical technologies used for family planning
Cook-Huynh et al.[22]	Adults aged 18 years + sample size of 326 adults	Two-tier random sampling	Adankwame Community	Increase in diabetes and hypertension prevalence Overall prevalence of diabetes mellitus was 0.077 (95% CI 0.05–0.11)
Danquah et al.[23]	1 466 individuals were recruited from diabetes and hypertension clinics, outpatients, community and hospital staff	Simple random	Komfo Anokye Teaching Hospital (KATH)	Type 2 diabetes affects predominantly obese patients of rather low socioeconomic status
Doherty et al.[24]	Three focus-group discussions among 30 persons and 10 individual interviews were used	Convenience sampling	Komfo Anokye Teaching Hospital (KATH)	High diabetes knowledge among diabetics High adherence to diabetes management precautions among diabetics
Frank et al.[39]	1 221 adults (679 controls and 542 cases with diabetes)	Simple random	Komfo Anokye Teaching Hospital (KATH), Kumasi	A 'purchase' dietary pattern (characterised by high intakes of sweets, rice, meat, fruits and vegetables) and a 'traditional' dietary pattern (characterised by high intakes of fruits, plantain, green leafy vegetables, fish, fermented maize products and palm oil) are associated with the risk of type 2 diabetes in this population
Gatimu et al.[35]	Adults 50 years and above	Multistage stratified cluster sampling	Ghana	Females were more susceptible to diabetes than males Physical inactivity was prevalent in urban females Obesity was a key risk factor
Minicuci et al.[37]	4 724 adults aged 50 and above	Stratified, multistage cluster sampling	Ghana	Diabetes was more prevalent in women than in men (4.4% and 3.2% respectively) Major risk factors: Physical inactivity, excessive smoking and low intake of fruits and vegetables Obesity (more prevalent among urban individuals and high-income urban dwellers)
Sarfo-Kantanka et al.[21]	A total of 1 292 individuals were sampled for the study	Convenience	Kumasi Metropolis	Diabetes was prevalent among both men and women but increased with age and weight The main risk factors for diabetes were overweight and obesity

Article/Author	Characteristics of respondents	Sampling technique	Study area/location	Result
Tarekegne et al.[36]	Study populations from WHO-SAGE wave 1(5 573 from Ghana and 4 227 from South Africa) aged 50+	Stratified random sampling	Ghana	Predisposing risk factor for diabetes was physical inactivity
				Risk of diabetes increased with age
				Respondents living in urban areas were more susceptible to diabetes than their rural counterparts
				Employed respondents were 45% less likely to report diabetes diagnosis and treatment, compared with those unemployed (OR 0.55; 95% CI 0.37–0.81)
				People with higher level of education were more susceptible to diabetes than those with little or no formal education
				Rich people were more prone to diabetes than the relatively poor
				Obesity was identified as a key risk factor for diabetes
Titty et al.[38]	456 diabetic patients aged 40 years and above	Simple random	Komfo Anokye Teaching Hospital	More Ghanaian females with diabetes than males Prevalence of diabetes increased with age among both males and females Obesity characterised by excess body fat was noted as the major risk factor for diabetes

was 18 years with the maximum age being 40 years and above. In terms of spatial distribution, some of the studies were conducted in rural communities of Adankwame,[22] Akwaaduo and Denyase[19, 25] whereas others were conducted in urban centres of the Kumasi Metropolis,[21,23,38] Oforikrom Sub-Metro[26] and Obuasi Municipal.[19]

All studies conducted in rural parts of the Ashanti Region found an increasing rate of diabetes among older adults.[19,25] However, in terms of gender disparity, Addo et al.[25] found the prevalence of diabetes to be higher in females than in their male counterparts, particularly in females with higher levels of education. This finding is slightly different from what Sarfo-Kantanka et al.[21] found in the Kumasi Metropolis, which indicated diabetes prevalence in both males and females as grossly underpinned by increasing age and body mass. In their nationwide survey, Minicuci et al.[37] found diabetes prevalence in women to be higher than in their male counterparts at a rate of 4.4% and 3.2% respectively. However, a later study conducted by Agbogli et al.[26] noted that diabetes prevalence was similar in both males and females.

In terms of risk factors, Addo et al.,[25] Agbogli et al.,[26] Gatimu et al.,[35] Tarekegne et al.[36] and Titty et al.[38] all found changing psychosocial risk factors to be major risk factors of diabetes among older adults in the Ashanti region. Aikins et al.[19] also found factors such as unhealthy dietary pattern, overeating and high alcohol consumption to be prominent among adult diabetic patients. Agbogli et al.,[26] Danquah et al.,[23] Frank et al.,[39] Minicuci et al.[37] and Tarekegne et al.[36] all found obesity and high intake of sweets, meat and starchy vegetables (corn and peas) also to be high risk factors for diabetes. Some studies also found a high rate of physical inactivity among diabetic patients.[35,36] Whereas diabetes has been judged as predominant among obese patients in the region, Danquah et al.[23]

found that the disease is more prevalent among obese patients with low socioeconomic standing than in patients with high socioeconomic standing. However, Tarekegne et al.[36] found a higher prevalence among people with high socioeconomic standing (financially) and also among people with high levels of education. They further ascertained that diabetic patients who were employed were 0.45 times more likely to report diabetes diagnoses and treatments compared with unemployed diabetic patients. It has also been established that urban residents are more susceptible to type 2 diabetes as compared with their rural counterparts.[36,37,39] Doherty et al.[24] also found a high level of diabetes knowledge among patients with diabetes as well as high adherence to diabetes management precautions in the region.

Discussion

With the overriding objective of ascertaining and examining the most common risk factors for type 2 diabetes among older adults in the Ashanti Region of Ghana, this study systematically reviewed 12 articles that met certain predefined inclusion criteria. Findings from the study are discussed below.

Physical inactivity as a risk factor for type 2 diabetes

From the extensive literature review, physical inactivity has generally been identified as the predisposing risk factor for diabetes mellitus among adults in the region. This could be explained by the high concentration of the region's population in urban areas, particularly in Kumasi, which is the second largest metropolitan agglomeration in the country. According to the Ghana Statistical Service (GSS) report,[40] about 53.5 of the region's population live in urban areas. As a result of this, most people are engaged in commercial activities which are sedentary in nature.[19] According to Gato et al.,[41] most market women and people employed in the formal sector spend more than half of their active hours sitting down at workplaces and in the

domestic environment. This has also been identified as a major cause of type 2 diabetes mellitus in the Ho Municipality of Ghana.[42]

Obesity as a risk factor

Furthermore, obesity has also been identified as a prevalent risk factor for the disease among adult Ghanaians in the Ashanti Region. This could be as a result of the prevalent rate of obesity in the region (43.4%), a rate that is nearly equal to the national prevalence rate of 45.6%.[13] This can be explained by the recent rate of urbanisation in the region, which has led to several lifestyle and behavioural changes: sedentary socioeconomic activities and patronage of processed foods, among others. This underpinned the finding by Obirikorang et al.[43] of lifestyle changes as the major precursor of obesity in the region. Lifestyle changes are largely influenced by socioeconomic standing, hence the confirmation of the finding by Tarekegne et al.[36] that people living in urban areas are more susceptible to type 2 diabetes than their rural counterparts.

Prevalence of type 2 diabetes mellitus among adults in the Ashanti region

Regarding prevalence of diabetes, it has been established that type 2 diabetes is more prevalent in urban centres than in rural areas. Even though the national prevalence rate is only 2.5,[1] the average rate established in the literature within the Ashanti region is 3.8,[19,37,38] which is higher than the national average. This could be as a result of the predominance of the psychosocial risk factors in urban centres of the region.[19] Gudjinu and Sarfo[14] intimated that due to the high cost of living in urban centres, people tend to spend more time working with little consideration of their eating habits. As a result, most adults finish work late, which eventually leads them to taking their supper late. This, coupled with a high intake of junk, processed and fast foods, weakens the immune systems of the majority thereby making them vulnerable to obesity, a key risk factor for diabetes. On the other hand, rural people, due to their active engagement in agrarian economic activities, are more physically active than their urban counterparts.[43] This explains their reduced vulnerability to type 2 diabetes in the region. However, it has also been reported that there is high adherence to diabetes management precautions in urban areas of the region as compared with rural areas.[24] This could be the result of the generally high levels of education in urban Ghana as compared with rural areas. The finding of diabetes being more prevalent in urban areas of the study area is in line with the findings of Asamoah-Boaheng et al.,[12] Schulze et al.[44] and Vuvor et al.[45].

The prevalence of diabetes among females across the rural and urban milieus of the region has also been evident in the literature. The primary reason could be the result of the higher population of women than men in the region.[40] Cultural values and belief systems that recognise men as the head of families among all Akan tribes place the charge on men to be benefactors to their families. As a result, most men are associated with rigorous socioeconomic activities that are nomadic in nature. According to Asamoah-Boaheng et al.[12] and Obirikorang et al.,[43] their engagement in such activities reduces their risk and vulnerability to type 2 diabetes. On the other hand, females (particularly those in urban areas) engage largely in sedentary lifestyle activities such as food vending, provision store operations, babysitting and banking, among others.[25] Some of these activities have been reported as major causes of diabetes among adults in the region. Women are also

regarded as baby-makers, hence are largely confined to homes and kitchens in some urban and rural communities in the region.[35,37] This finding corroborates that of Asare-Anane et al.[46] and Bawah et al.,[42] who also identified a high prevalence of type 2 diabetes among urban females in Ghana. Despite this, the literature has expanded knowledge on the high susceptibility of urban dwellers to the disease. This can be attributed to the high rate of urbanisation in the region, coupled with changing socioeconomic status. According to Songsore,[47] the Ashanti region has one of the fastest rates of urbanisation in the country (53.2%), which is above the national average of 43.2%. Addo et al.,[25] Aikins et al.[19] and Gato et al.[41] all identified the close association between increasing socioeconomic status (in terms of education and income levels) and the risk of developing type 2 diabetes mellitus.

Conclusion

As a result of the predominance of psychosocial risk factors of diabetes, specifically physical inactivity and obesity, in the Ashanti region of Ghana, there is a need for intensified public awareness creation on the menace of this disease in the region. All key stakeholders in the health sector, including the Ministry of Health and Ministry of Information in conjunction with media houses and governments at the local levels, have the responsibility to educate the entire population on diabetes, and its prevention, management and the available interventions. This would go a long way to help achieve massive reduction in diabetes cases in Ghana. Women also need to be educated on the need to exercise their bodies regularly to facilitate a reduction in their chances of developing type 2 diabetes. Finally, as part of adolescent education, there is a need to teach young people to avoid certain lifestyle choices such as smoking, excessive intake of alcohol, and too much intake of processed and fatty foods, which could predispose them to type 2 diabetes in old age.

ORCID

Daniel Katey https://orcid.org/0000-0002-1269-0550
Kabila Abass https://orcid.org/0000-0001-6662-6688
Anthony Kwame Morgan https://orcid.org/0000-0001-7904-9955

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