Review Article

Knowledge of diabetes mellitus in the school: A systematic review of African Studies

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Abstract

The rising prevalence of diabetes mellitus (DM) among teachers and students in Africa is becoming disturbing. Compounding the problem is the existing poor knowledge of the basic critical elements of DM among teachers and students. This study was designed to review studies underlining the knowledge of DM among teachers and students in Africa. We searched Pubmed, Google Scholar, Medline, Scopus, African Journal Online, Science Direct, and the Cochrane Library. Using MeSH headings, such as ''diabetes mellitus,'' ''knowledge,'' "primary," "secondary" students," "teachers," "educator," "instructor," and ''Africa'' from year 2000 to 2019. Out of the 6 eligible studies, 1 was conducted among teachers while 5 were conducted among students. Four of the studies were conducted in West Africa and 2 in Southern Africa. The mean ages of the students were 15.67 ± 1.25 years and 15.2 ± 1.30 years respectively, while the mean age of the teachers was 36.8 ± 8.0 years. The 3 cross sectional studies reported poor knowledge of DM among teachers and students while the three interventional studies among the students reported poor knowledge of DM prior to the intervention and an increased knowledge of DM at post intervention. The review highlights the poor knowledge of the critical elements of DM among teachers and students. Therefore, necessitating the need for regular health education in increasing the knowledge of DM in the school environment and in the long term reduce the impact of DM among teachers and students.

Keywords: Africa; Diabetes mellitus; Knowledge; School; Students; Systematic review; Teachers.

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Introduction

The rising prevalence of non-communicable diseases in low and middle-income countries has assumed a pandemic state. The four conditions of cardiovascular diseases, diabetes, cancer and chronic respiratory diseases are now reported in Africa as the most common causes of premature death and disability. [1] An estimated 15.5 million adults aged 20-79 years have diabetes in Africa, and the number is expected to increase to 162.5% in the year 2045. [2] In Africa the reported prevalence of diabetes mellitus (DM) in some countries are; Ethiopia with 2.6 million, South Africa with 1.8 million, Democratic Republic of Congo with 1.7 million and Nigeria with 1.7 million people.[2]

Furthermore, while DM prevalence has been reported among the general population; [3-9] DM has also been reported among teachers and students in primary and secondary schools in Africa. [10-21] This would confer burden on the affected teachers and students, which could lead to poor output in terms of teaching and learning activities in the school.

The burden of DM could be drastically reduced if patients are empowered with the right knowledge for management of the disease, including preventing its risk factors. Consequently, awareness and knowledge of DM are important for people to develop the right attitude towards the disease and also increases their likelihood of participating in prevention and control activities. [22] This demonstrates the importance of knowledge of DM in its prevention, control and management. However, both teachers and students have been shown to demonstrate poor knowledge of DM. [23,24] This becomes more disturbing as patients with insufficient knowledge of DM have been shown to have poor self-care management practices. [25] Therefore, this systematic review was designed to:

1) Determine the level of knowledge of teachers and students on DM

2) Show the paucity of studies in assessing the knowledge of teachers and students in schools in Africa.

It is hoped that this would bring to focus the issue of DM among this cohorts in order to stimulate the implementation of intervention programmes to ensure health-promoting primary and secondary schools across Africa

Methods

Study design

This is a systematic review of the knowledge of diabetes mellitus among teachers and students in both primary and secondary schools in Africa countries following the PRISMA guideline. The included studies were extracted by two of the author's AO and OOR using standardized data extraction forms. Characteristics of identified studies extracted were the study location, year of

study, the broad objective of the study, study design, sample size, age, and study outcome.

Study area

The study area comprised all regions of Africa, including South, East, West, North and Central Africa.

Data sources and searches

A systematic collation of published data over the period of the year 2000 to 2019 on knowledge of DM among teachers and students was retrieved between April and October 2019 to highlight the distribution of knowledge of DM in both primary and secondary schools in Africa. The authors searched electronic online bibliographic archives such as Pubmed, Google Scholar, Medline, Scopus, African Journal Online, Science Direct, and the Cochrane Library. Using MeSH headings, the terms ''diabetes mellitus,'' ''knowledge,'' "primary," secondary," "students" "teachers," "educator," "instructor," and ''Africa'' as well as variations thereof were searched for. The last search was performed on 8 November 2019. Studies included in the systematic review were those that assessed the knowledge of DM among teachers and students in primary and secondary schools. Interventional studies which also assessed the knowledge of DM among students were also included in the review. In all, a total of 6 studies involving 2803 teachers and students were evaluated. Thus, 1 study comprising 215 teachers and 5 studies comprising 2588 students were included in the systematic review.

Inclusion criteria

Only school-based studies that assessed knowledge of DM among teachers and students and were executed between 2000 and 2019 in Africa were included in the systematic review. Furthermore, included studies were cross-sectional and interventional studies published in the English language.

Exclusion criteria

Excluded studies from the systematic review were those not assessing knowledge of DM, not carried out before the year 2000, in the university and other tertiary schools, those published in other languages aside from English.

Study selection and data extraction

For teachers, a total of 1323 potential articles were indicated in the initial literature search after removing duplicates, of which only seven full-text articles were screened for eligibility, and only 1 study was included in the qualitative synthesis (Fig 1). For students, 5423 potential articles were indicated in the initial literature search after removing duplicates, of which 11 full-text articles were screened for eligibility, and only five studies were included in the qualitative synthesis (Fig 2). Data from various eligible studies were extracted for the knowledge of DM, broad objective of the study, study design, sample size, study outcome and African country in which the study was carried out. A summary of the data extracted is, as shown in Table 1. We coded the data based on the name of the first author of the study and the year that the study was published.

Figure 1: *Flow diagram of studies (Teachers) included in the systematic review*

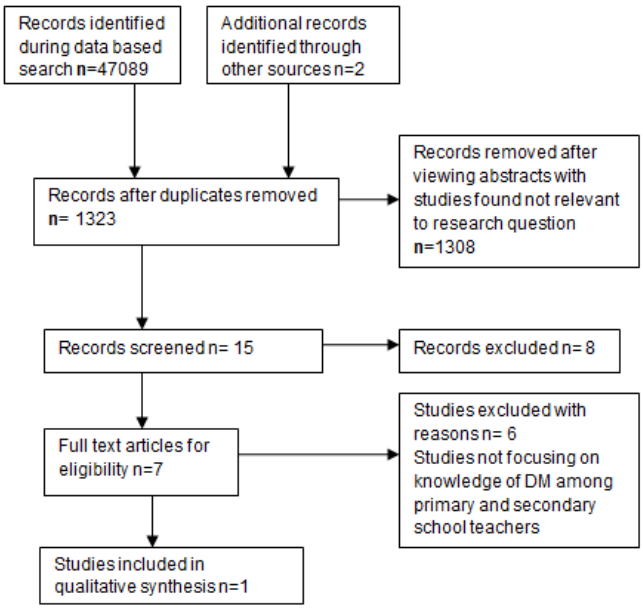
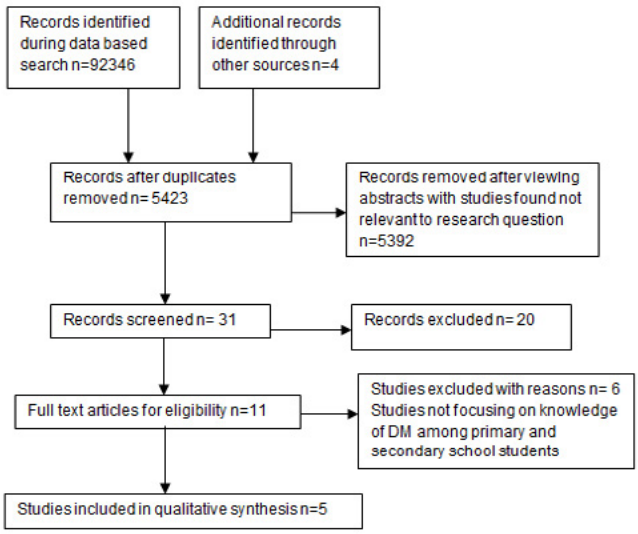


Figure 2: *Flow diagram of studies (Students) included in the systematic review*



Compliance with ethical standards

This review was the preliminary phase of a larger study among teachers, students and community participants of which the study protocol was reviewed and approved by the Delta State Ethical Review Committee.

Data analysis

All the relevant information was entered into an Excel spreadsheet, and data analysis was performed using SPSS (Version 20 for Windows, SPSS Inc., Chicago, IL).

Results

The eligible study among teachers was carried out in Ghana Western Africa. [26] The study was a cross-sectional study. The sample size distribution for the eligible study was 215 teachers. The ages of the teachers were between 20-59 years, with a mean age of 36.8 ± 8.0 years (Table 1).

Table 1: *Studies included in the systematic review among teachers*

Country	Year	Objective	Design	Sample Size	Mean Age	Study Outcome	Reference
Ghana	2015	To determine the knowledge deficits about DM among school teachers in Ghana		215	36.8 ± 8.0 years	Teachers have limited knowledge of DM management & pvractices	Amissah et al .[26]

Among the eligible studies among students, three were carried out in Nigeria [27-29] and 2 in South Africa. [30,31] In addition, 3 of the studies were interventional studies to improve the knowledge of DM among students [27,30,31] and 2 were cross-sectional studies. [28,29] The sample size distribution for the eligible studies were 894 students (456 health club members vs 438 non-health club members), [27] 451, [30] 113 students, [31] 250 students [28] and 880 students. [29] One of the studies involving students were between the ages of 14-16 years with a mean age of 15.67 ± 1.25 years. [27] Furthermore, another study showed that majority of the students in that study were aged between 10-13 years 30, while about half of another study in South Africa were aged between 8-13 years. [31] Further, the study in Nigeria showed the students were aged between 11-19 years with a mean age of 15.2 ± 1.3 years [28] and the last study showed the ages of the students were between 10-19 years [29] (Table 2).

Table 2: *Studies included in the systematic review among students*

Country	Year	Objective	Design	Sample Size	Mean Age	Study Outcome	Reference
Nigeria	2014	To determine the outcome of school health club awareness program amongst school children in Oyo State	A comparative interventional study	894	15.67 ± 1.25 years	More health club members were aware of DM than non-club members	*Omisore et al [27]
South-Africa	2011	To determine the effects of service learning-based health promotion influence on knowledge of DM	Pre-post interventional study	451		Improved knowledge of DM among junior & senior school participants	Srinivas et al [30]
South-Africa	2018	To determine the effects of a health education programme on increasing knowledge of DM	Pre-post interventional study	113		Increase in post-intervention knowledge of study participants	Mhlongo et al [31]

Nigeria	2016	To determine the knowledge of DM & self-reported risk factors among adolescents in senior secondary school	Cross-sectional	250	15.2 ± 1.3 years	The study participants had inadequate knowledge of DM	Ubangha et al [28]
Nigeria	2014	To determine the level of awareness and basic knowledge of diabetes among adolescents in secondary schools	Cross-sectional	880	15 ± 2 years	Awareness and knowledge of diabetes among adolescents in Port Harcourt was low	Okoh & Jaja [29]
*Health clubs were formed with the aim of making adolescents aware of NCDs, and their risk factors through health educational programs over a three year period (2010 – 2013).							

Knowledge of diabetes mellitus among the teachers

The knowledge of teachers in the included studies shows that majority 97.0% of the teachers knew that diabetes was as a result of increased blood sugar levels, while majority 39.10% did not know the types of DM and frequent urination was identified as a symptom of DM by 67.8% of the teachers. In addition, majority (81.8%) of the teachers knew that DM can cause complications in other organs, with 84.8 listing poor wound healing as complications of DM and 35.3% listing family history of diabetes as the most risk factors for DM. Most of the teachers affirmed that they do not know how to treat low sugar and they do not know the effect of fruit juice on blood sugar. In addition, the teachers' demonstrated knowledge of diabetes management practices as most of them affirmed that it is important for students with diabetes to have competency in using glucometer, allowing student with diabetes to use restroom, competency in insulin injection, preventing diabetic student from eating sweet at school and talking about diabetes with diabetic student. The authors concluded that teachers have inadequate knowledge of the basic facts of diabetes and management of children with diabetes in schools, a situation which could have dangerous consequences for the child with diabetes. [26]

Knowledge of diabetes mellitus among the students

In the study among students in Oyo state in Nigeria an intervention study was designed with the formation of school club members which had educational intervention on DM and non club members who did not have any intervention on DM. The study was designed to assess the difference in knowledge of DM among club members and non-club members. Majority of the students were aware of DM. The club members showed knowledge of risk factors of DM, causes of DM complications and DM prevention. The mean aggregate scores for knowledge of DM were higher among school club members than non club members (6.5482 and 5.9772). Similarly, the component score of knowledge of DM was also higher in school club members than non-members (93.5463% and 85.3880%). The authors concluded that despite the high awareness, knowledge of risk factors, prevention and complication of diabetes seems to be poor especially among non club members who did not receive any education/ training on diabetes mellitus. [27]

The pre-post intervention study in South Africa was conducted among junior and senior secondary school students. The study was a designed computer based intervention that assessed the pre-intervention knowledge of DM and post-intervention knowledge of DM among the students. The results show that the junior students had reasonable prior knowledge of DM, with an overall percentage score of 75.9%; range: 65.5-83.2%. The intervention resulted in a significant increase in correct responses among the junior students as well as a significant improvement in the participants' overall percentage scores. For the senior student the pre-intervention questions show that the participants had fair prior knowledge of DM, with an overall percentage score of 57.5%; range: 30.4-76.5%. The intervention resulted in a significant increase in the participants' overall percentage knowledge scores. The authors concluded that although the SciFest attendees had some prior knowledge of DM, interaction with the health-promotion activity resulted in an increase in knowledge. [30]

The other South Africa study was designed to determine the effects of a health education programme on increasing knowledge about diabetes among junior and senior school students. The programme incorporated presentations, posters, health models, word-search games, information leaflets and a computer-based quiz consisting of pre- and post-intervention questions. The pre-intervention results show that the junior learners had fair prior knowledge of diabetes, with an overall mean score of 52.8%. Furthermore, among the senior learners the results of the pre-intervention study showed the senior learners had fair prior knowledge of diabetes, with an overall score of 59.1%. Improvement in the overall knowledge of participants after the intervention was significant at the 0.1% significance level ($p<0.001$). The authors concluded that public health education on diabetes remains a cost effective approach to reach out to students and the

broader community. [31]

The study in Nigeria was a cross sectional study among senior secondary students. The results of the study show that most of the students have heard of DM. Furthermore, most of the students correctly defined DM as an abnormally high blood glucose level. In addition, about 53.94% demonstrated overall poor knowledge of DM, and 8.4% of the respondents had a family history of DM. The authors concluded that there was poor knowledge of DM among the students, despite the existence of risk factors. [28]

Furthermore, the study in Nigeria was a cross sectional study carried out among in-school adolescents. The study showed high awareness of diabetes among the students, less than half knew that diabetes meant an abnormally high blood glucose level, but only 2 (0.2%) were aware that it was due to deficiency of insulin. Most of those who knew that diabetes was associated with raised blood glucose thought that the cause was an excessive intake of sugar and 37% could name at least two symptoms. The authors concluded that awareness and knowledge of diabetes among adolescents in Port Harcourt was low, and possibly represents the knowledge of the general populace. [29]

Discussion

The few studies highlighted by the review shows, especially among teachers, the lack of attention given to the prevention of DM in schools in Africa despite the reported prevalence of DM among teachers in Africa. 10-15 In addition, even the prevalence of prediabetes and diabetes mellitus has also been reported in Africa. 16-21 This shows the prevalence of DM in schools in the continent and calls for the implementation of interventional programs to reduce the prevalence of DM and complications of DM among teachers and students. Furthermore, the spread of the age groups from adolescents, to youths, early adulthood and late adulthood highlighted the importance of targeting all age groups in the fight against DM. This is becoming more important as DM has been projected to be on the rise across all age groups in Africa. 2

The review of the knowledge of the eligible studies shows that despite the majority of the teachers demonstrating knowledge of the causes of DM as a result of increased blood sugar levels, some do not know the types of DM, do not know how to treat low blood sugar and do not know the reported effect of fruit juice on blood sugar. [26] To achieve a health-promoting school where teachers and students would be healthy; there is need to educate teachers on DM as their adequate knowledge of DM and its management would equip them in managing hyperglycaemic and hypoglycaemic crisis within the school environment.

The role of creating awareness and knowledge of DM has been identified as the best weapon towards curbing the diabetes pandemic in Africa. This fact was corroborated by the interventional study among students which showed higher mean knowledge scores among club members who received an educational intervention when compared with non-club members who did not receive an educational intervention. [27] Furthermore, a pre-post interventional study among junior and senior secondary school students also corroborated the importance of educational intervention in improving the knowledge of DM among students. The intervention in the study resulted in a significant increase in correct responses among the junior and senior students as well as a significant improvement in the participant's overall knowledge percentage scores. [30] Similarly, the other interventional study also resulted in significant improvement in the overall knowledge of DM among the students after the intervention. [31] In addition, a health education intervention among medical students in Port Harcourt Nigeria also substantiated the importance of health education to improve knowledge of DM. [32] Other studies have shown the effectiveness of the educational intervention in improving the health outcomes of certain psychological factors of patients with type-2 DM, [33] and the knowledge of patients with type-2 DM. [34]

Furthermore, the remaining two cross-sectional studies also showed poor knowledge of DM among the surveyed students. [28,29] This shows the pattern of inadequate knowledge of DM among students in Africa and provides a gap which should be addressed immediately through health education as the prevalence of DM is on the increase in Africa.

Limitation of the study

The review was a retrospective study of previously published studies. Therefore, the authors relied solely on the report of the selected studies in writing the review. In addition, the review only captured West and Southern Africa because these were the parts where studies were available, thus generalizing the results to other parts of Africa not captured in the review should be done with caution. These limitations, not with-standing, the review has documented the knowledge of DM among teachers and students in Africa.

Conclusion

Poor knowledge of DM is prevalent among teachers and students in Africa as highlighted by the review. Besides, as shown by the review, health education is a good strategy to improve the knowledge of teachers and students. Therefore health education focusing on all aspect of DM management and prevention should be embarked on by concerned stakeholders in both primary and secondary schools to improve the knowledge of teachers and pupils/students on DM.

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