QUALITY OF TYPE 2 DIABETES CARE BASED ON LIPIDS CONTROL IN SUB-SAHARA AFRICA: A SYSTEMATIC REVIEW

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ABSTRACT

Background: Diabetes Mellitus is a growing medical concern in Sub-Saharan Africa (SSA). Currently, urbanization and shift in epidemiological patterns are making this condition increasingly prevalent in this developing region.

The quality of care provided to diabetics based on lipid control in Africa may not be optimal. Nevertheless, there is little evidence to support these claims. Systematically assessing and summarizing the existing literature related to quality of care for patients with type 2 diabetes mellitus (T2DM) was necessary, while also identifying any gaps in information and exploring possible barriers to care in an SSA context.

A systematic overview of the available evidence on diabetes care in this region will be able to help policy makers and health care providers make well-informed decisions.

Aim and Objectives: By addressing the following questions, the systematic review examined the existing management of type 2 diabetes in sub-Saharan Africa:

i. How good is the current control of type 2 DM in SSA based on indicator outcome of lipid levels?
ii. Have implemented strategies, treatment or interventions improved the outcome of type 2 DM in Sub-Saharan African countries?

Methods: A systematic review of quantitative studies was carried out. It was done on a population of people with type 2 diabetes in sub-Saharan Africa. We considered all ages, gender, ethnicities, racial backgrounds, migration statuses, education levels, and socioeconomic backgrounds. In addition to cross-sectional, experimental and quasi-experimental studies, observational studies and reviews were also included. The review focused exclusively on full papers and not abstracts. Conference proceedings, editorials, and case reports were not included in the review. Search strategies were developed using two databases - MEDLINE via Pubmed (1946 to February 2013) and EMBASE via Ovid (1974 to April 2013). Search strategy included lipids, cholesterol, and lipoproteins, as well as terms related to these. Reference lists from derived papers were searched and experts contacted. As the primary outcome of interest, we extracted and summarized data on lipid control measures. Process-related outcomes, such as frequency of lipid level documentation, were secondary outcomes. Duration and complications as related to lipids control of diabetes were also considered.
Also assessed were the interventions or implementation approaches used in the studies or the data collected. Study quality was assessed using the Effective Public Health Practice Project's quality assessment tool.

Results: The review identified and included ten published studies. These were all cross-sectional studies. Interventions focused on diabetes management and preventing complications were the most consistent, followed by drug treatment, then dietary measures. Target levels of total cholesterol were not met in 18% to 43% of patients

across studies. 66.1% to 73.5% of patients did not meet the target levels of LDL-C while 35% to 85% of patients did not meet target levels of HDL-C. 40% to 60% of patients did not meet target levels of triglycerides.
Conclusion: The quality of care for type 2 diabetes in sub-Saharan Africa is sub-optimal based on lipid control. Consequently, quality of care needs to be improved in this region. The quality of care in this region is likely to be improved by a variety of interventions, mainly secondary prevention strategies, and implementation strategies. The local population would benefit from targeted interventions and strategies. A consideration of factors impeding quality of care must also include barriers to good diabetes management.

Keywords: Type 2 Diabetes Mellitus, Lipids, Sub-Sahara Africa

INTRODUCTION:

Diabetes mellitus is defined by the World Health Organization (WHO) as a metabolic disorder involving prolonged hyperglycemia and changes in carbohydrate, fat, and protein metabolism as a result of impairments in insulin secretion or insulin action or both[1]. Over 90% of diabetes cases in Sub-Saharan Africa are due to type 2 diabetes [2,3]. The common cause of T2DM is insulin resistance or impaired insulin sensitivity, along with reduced insulin secretion [4].

Because of its mild or non-existent symptoms, T2DM may go unnoticed for many years and may lead to severe long-term complications. A combination of genetic and environmental factors, such as a high-calorie diet and physical inactivity, may lead to the development of T2DM. Alcohol, smoking, and certain medications may also contribute to the development of the disease. In this systematic review, T2DM was considered due to its higher prevalence compared to people with TIDM. Therefore, poor management and control of T2DM may have greater public health consequences.

The number of people with T2DM worldwide was estimated at 171 million in 2000. By 2030, this number is expected to reach 366 million [5]. Sobngwi and colleagues [6] noted that diabetes prevalence ranges from 1% in rural areas to 6% in urban areas of Africa. A systematic review conducted by Hall et al [7] on the epidemiology and public health implications of diabetes in sub-Saharan Africa found that the prevalence rate ranged from 1% in rural Uganda to 14% in urban Kenya.

Sub-Saharan Africa is experiencing an increase in diabetes mellitus cases. Increasing urbanization and epidemiological transition are contributing to the prevalence of this condition in this developing region [5,6,8,9]. In sub-Saharan Africa, there are very few data on prevalence of diabetes. The prevalence of diabetes in sub-Saharan Africa could reach 23.9 million by 2030[5,6] due to a projected increase of 98% every decade [5,6].

With its attendant complications, type 2 diabetes mellitus has a negative impact on quality of life for individuals and their families [10]. Individuals, families, and governments will incur additional costs to treat patients and manage complications.

Having diabetes, increases the risk of morbidity and mortality primarily because it is associated with microvascular and macrovascular complications. In Africa, Mbanya and Sobngwi [11] found that 16-55% of diabetics had retinopathy, while newly diagnosed patients accounted for 21-25% of this. The fact that most persons are asymptomatic and individuals have been undiagnosed for long periods and have poor blood glucose control, could explain the presence of complications at diagnosis. T2DM care is sub-optimal in SSA, based on this evidence. In populations with poor blood glucose control, the highest prevalence of retinopathy is observed in T2DM patients with poor glycaemic control [11]. Peripheral neuropathy usually occurs after a diagnosis of type 2 diabetes while nephropathy is associated with poor blood glucose control, high blood pressure and retinopathy [11]. The same study noted that diabetic complications accounted for 30.8% of outpatient care costs at a major city hospital in Tanzania. On average, US $138 was spent per patient annually, which is 19 times more than the average government expenditure on health.

Patients with T2DM or metabolic syndrome X, which includes dyslipidemia, hypertension, and

central obesity, are most likely to develop macrovascular complications. The combination of these factors can greatly increase cardiovascular risk . Those with T2DM are at greater risk of developing cerebrovascular disease, coronary artery disease, and cardiomyopathy [11,13,14]. African populations with an increased prevalence of dyslipidaemia are at higher risk of cardiovascular events [11,15].

SSA is also experiencing an increase in T2DM prevalence due to factors similar to those affecting worldwide rates. An analysis of a modelling study showing an increase in diabetes prevalence and plasma glucose in Mauritius [16] concluded that most of the increase was due to modifiable factors, rather than changes in mortality rates.

Risk factors that can be modified include cultural and social changes. Consequently, poor dietary habits, sedentary lifestyles, obesity and other unhealthy behaviors may worsen T2DM, increase the risk of complications or even lead to the development of the disease. The aging population and ethnicity are two factors not modifiable. Complications associated with these changes need to be prevented or delayed [19, 20]. Among the interventions recommended are healthier eating, increased physical activity, avoiding cigarette smoking, and structured education. Medicine may also help. In T2DM patients, these measures attempt to control three important indicators: blood glucose, blood pressure, and lipids [20]. Yet, despite some achievements (2007), only about 15% of adults with T2DM met all three targets at the same time [21, 22]. These findings may reflect the poor effectiveness or implementation of the recommended strategies or poor compliance to these strategies. Thus, improvements in the quality of care among T2DM patients may be impeded.

According to the Diabetes Foundation (DF) Report on Implementing National Diabetes Programmes in Sub-Saharan Africa, the current approach to managing diseases in SSA is focused on acute infectious diseases. However, similar approaches cannot be used to treat chronic diseases like diabetes. In addition to long-term follow-up and treatment for diabetic patients, continuous self-management is necessary. Several interventions are currently being carried out to improve the quality of diabetic patients' care in order to achieve better outcomes [24].

The effectiveness of these interventions in reducing T2DM is still unclear. A lack of follow-up of outcomes may account for the lack of certainty here. Clinical outcomes such as blood pressure as a measure of control were considered in this systematic review. Additionally, interventions may not work due to barriers such as poor feasibility, efficacy, or acceptability. Between ideal and actual interventions in management, clinicians are currently at odds [24, 25]. Patient self-management and clinician behavior may contribute to inadequate control of these indicators [21, 26]. It may still be difficult to change patients'behavior on healthy lifestyles.

The Diabetes Foundation report [23] suggests a few key areas where good quality of care can be achieved for diabetic patients. In addition, prevention strategies - primary, secondary, and tertiary - are essential, as are access to diagnostic tools and infrastructure, drug supply and procurement, affordability of medicine and care, skills of health care workers, adherence by patients to management and community engagements [23]. Due to the increasing prevalence of T2DM and its health and economic consequences, it is important that effective strategies are implemented as soon as possible.

Diabetes care in Africa is reportedly sub-optimal. However, the evidence to support these claims [17] is unclear. For effective advocacy and action in this region, it is crucial to understand the extent of the disease burden. Despite this, little effort has been made to give policy makers and health care providers a systematic overview of the evidence available on diabetes care in sub-Saharan Africa [17].

In order to identify the gaps and explore the barriers to care in the SSA context, it was necessary to systematically assess the quality of care among patients with T2DM in existing studies. Screening for type 2 diabetes, for instance, has important implications for individual health and public health policy, according to the IDF guidelines [27]. Diabetes should be detected and treated early in order to minimize complications.There is also evidence that published national guidelines for type 2 diabetes management come from relatively resource-rich countries whereas they may be of limited practical use in less well-resourced countries like Africa.

Based on the scoping of the literature, we determined that limiting the systematic review to a single research question may yield very few studies, thus rendering the systematic review infeasible. As a result, we sought to address more than one interrelated topic related to diabetes care.

The aim of the review was to examine the existing quality of management of type 2 diabetes in SSA by addressing the following questions:

iii. How good is the current control of type 2 DM in SSA based on indicator outcome of lipid levels?

iv. Have implemented strategies, treatment or interventions improved the outcome of type 2 DM in Sub-Saharan African countries?

METHODOLOGY:

This study is a systematic review of quantitative research on T2DM in SSA. Using the PRISMA reporting guidelines, a systematic review protocol was developed [28]. A systematic review with no primary data collection did not require ethical approval.

Study Selection:

Inclusion:

People in SSA with T2DM made up the population. The review included participants of all ages, genders, ethnicities, residences, localities, immigration status, educational background, and socioeconomic status.

The studies included cross-sectional, quasi-experimental, experimental, observational, and review studies. All studies including lipid levels and/or it's control as outcome indicator were included. Only papers written in English were included. We included only full papers, not abstracts.

Exclusion:

In most cases, case reports are not representative of the target populations under study and were therefore excluded. We also excluded conference proceedings and editorials for pragmatic reasons. Upon consultation of their titles and abstracts, papers that failed to meet the inclusion criteria were excluded. Papers that presented partially available data were also excluded.

Outcome Measures:

Using lipid levels as the primary outcome measure, control was assessed. Documentation of lipid levels was the process measure. In addition to screening for diabetes and its complications, educating patients on management and prevention of complications were also considered secondary outcome measures. Also considered were individuals taking or administered medications including antilipid medications.

Information sources and search strategy:

MEDLINE and EMBASE were explored since both are large medical and biomedical databases relevant to the review topic. The search in Medline covered articles from 1946 to February 2013 while the search in Embase covered articles from 1974 to April 2013 to enable a detailed search to the period of the review. Population, indicators, comparators, and outcomes (PICO) were considered in reference to the review questions. A PICO deconstruction of the review questions was used. Two reviewers carried out the search. As a result of possible differences in database MeSH headings or dictionaries, the search strategy developed for one search database (Medline via PubMed) was adapted for a second database (Embase via Ovid). We searched the reference lists of the database-derived papers for relevant studies. An expert on the research topic also provided relevant papers.

Before being fully screened, the title and abstract of each study were reviewed and assessed against the inclusion criteria. Each paper was reviewed independently by two reviewers. The flow chart in Figure 1 shows the number of papers identified and screened in order to determine which papers are eligible for review.

Data Extraction and Quality Assessment

We extracted data from each study based on the following criteria: 1) study type, 2) participant characteristics, 3) country and setting (tertiary, secondary or primary hospitals), 4) intervention strategies, 5) complications among newly diagnosed

and undiagnosed T2DM patients or data collected on these 5) outcomes measurements (Table 1). Among the data extracted were summary statistics from papers.

Modifications were made to the tables based on the evidence available. An assessment of study quality was based on a combination of components in a quality assessment tool developed by the Effective Public Health Practice Project - EPHPP [29, 30]. Due to the type of studies included in the review, this tool had limitations. Cross-sectional studies, for example, made it difficult to assess blinding techniques and withdrawal from follow-up. In order to explain results differences across studies, quality assessments were used.

Data Synthesis:

A The findings were summarized and explained using narrative synthesis. Based on lipid control, the extracted data was grouped and summarized into types of studies and clinical outcomes.

RESULTS:

Types and characteristics of studies:

Table 1 shows the types and characteristics of studies. Ten studies were considered eligible and included in the review (Figure 1).

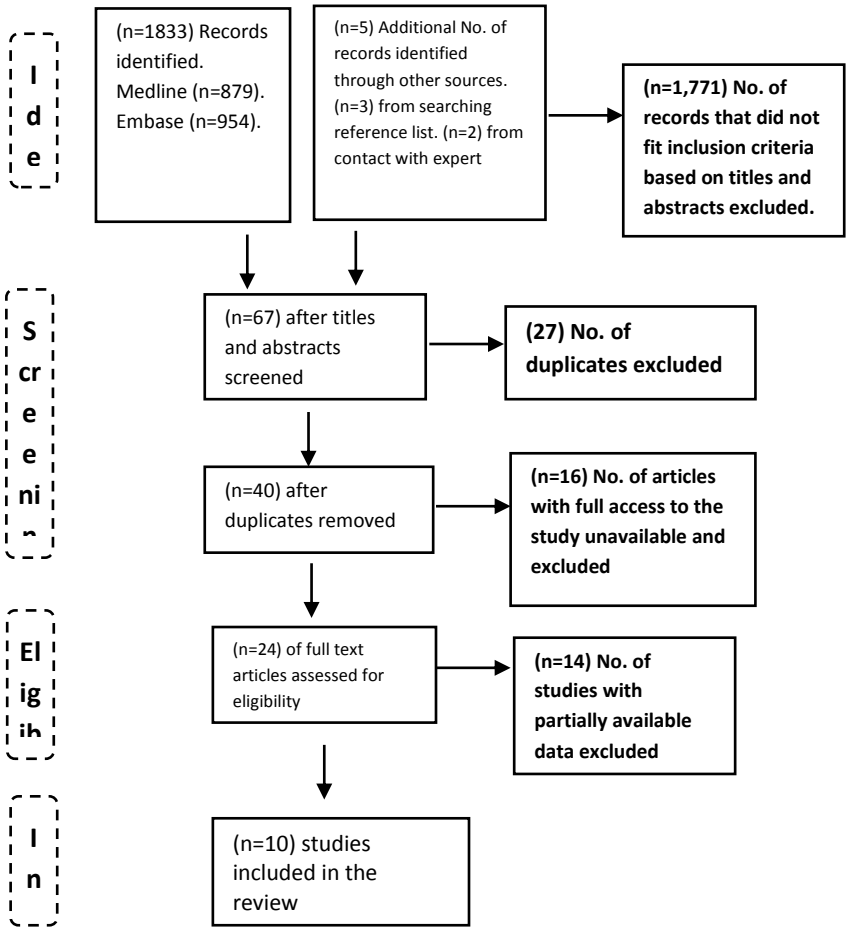

Figure 1: Flow chart of study selection process.

There were only cross-sectional studies [31-40] in the papers reviewed. No primary preventive measures or screening studies were found. Selection was to studies describing mainly secondary preventive measures of T2DM.

The studies were all conducted in tertiary hospitals or medical centers with the exception of two. One study was conducted in a primary health center, while the other was conducted at specialized clinics. In these studies, a variety of methods were employed, including retrospective review of patients' records and assessment during the study, as well as prospective methods. One cross-sectional study was comparative [40]. In some studies, type 2 diabetic patients were specifically included, while other studies used a mixed diabetic population predominantly comprised of type 2 diabetics. Study samples ranged from 62 [38] to 2352 [40]. Some studies had a higher percentage of males, while others had a greater percentage of females. The average age varied between 48 and 56 years across studies, as did the age ranges.

All studies looked at lipid control as a primary outcome. Diabetes education, lifestyle modifications, and medication were all part of the intervention. The intervention was carried out following a clinical algorithm. Across the studies [31-40], questionnaires, interviews, or a review of records were used to collect data about intervention strategies. Data on diabetes education seemed most consistent, followed by data on drug treatment, then dietary measures. Some of the strategies used to control diabetes included patient self-monitoring, treatment algorithms, chart reviews, clinic visits, and laboratory assessments. Secondary outcome measures included mean diabetes duration, therapeutic adherence, diabetic complications (e.g., retinopathies, neuropathies) and cardiovascular risk factors (such as smoking habit). Most studies did not take clinical guidelines into account. As a measure of lipid control, ADA and IDF guidelines were used as reference values for the indicator outcome

Table 1 summarizes the interventions, strategies, and outcomes, as well as the data collected by the project.

Table 1: Summary of Type of Study Design, Interventions, Outcome measures and data collected

Ref/Date of Study	Type of Study	Country	Sample Size	Population Characteristics	Intervention/ Implementation strategies/ Data collected	Outcomes Observed/ documented	Main Outcome(s)	Study Limitation
1.Gudina et al/2009	Cross-sectional	Ethiopia	329	-M:F = 1.46:1 Mean (SD) = 48.4 (15.1) -TH	-Diabetes health education -Review of charts for treatment of diabetes and causes of admission -Drug treatment for dyslipidemia	-follow-up visits -Mean duration of DM -Assessment of Diabetes related complications -Clinical outcomes	Lipid profile	- Poor chart keeping. -study design unable to assess chronic complications
2.Okafor/Ofoegbu 2011	Cross-sectional	Nigeria	233	42.1% males attending diabetic clinic in a TH	Degree of adherence to therapeutic measures	-Duration of DM -Clinical outcomes	LDL-C, TC, HDL-C, TG,	No consideration of effect of disease duration and duration of follow-up of patients.
3.Chineye et al/2008	Cross-sectional	Nigeria	531 (95.4% T2DM)	39.4% Males, Multicentre study including 7 tertiary health centres	-Clinic visits and clinical assessment -Patient self-monitoring -Diabetes education received by patient -Use of medications	-Mean duration of DM -Frequency of clinic visits and assessment -Adherence to dietary measures and exercise	HDL-C, TG	

					-Eye examination, lower limb examination. -cerebral stroke, neuropathy, myocardial infarction, renal failure	-Assessment of diabetic complications and cardiovascular risk factors		
4. Joseph et al 2009/10	Cross-sectional	Cameroun	205	Male=43.6%. Mean Age=57 Age Range= 29-85 Tertiary health centre	Regular chronic care with follow-up appointments	-Drug treatment rates -Mean duration of diagnosed diabetes -Assessment of cardiovascular risk factors and diabetic complications	TC, HDL, LDL	Selective non-random sample of participants that may not be representative of the population
5. Isezuo SA/2002	Cross-sectional	Nigeria	254	Males=154(60.6%) Outpatients and Inpatients in a TH	Laboratory assessment of components of the metabolic syndrome	Metabolic syndrome, obesity, microalbuminuria, hyperuricaemia	HDL-C, LDL-C, TC	Data collection methods not clearly stated
6.Christopher OA.	Cross-sectional	Nigeria	218	Males=58.7% Mean Age=52±5.8yrs. Range=36-62yrs	-Use of medications -Dietary measures	Duration of diabetes. Drug therapy. BMI, Microalbuminuria	HDL-C, TG	Statistical methods not clear
7. Berhane et al	Cross-sectional	Eritrea	429	Age=57.4±11.8	-Dietary treatment -Medications	-Assessment of complications -Lipid levels	TC, LDL-C, TG	Poor standardized lipid levels

8.Vezi/Naido 2002/03	Cross-sectional	South Africa	62	Age (Range) in years Males:49 (34-72) Females:50(33-69)	-Routine clinical examination and follow-up visits	-Assessment of liver, renal and thyroid function tests -lipid levels -Obesity	HDL-C, LDL-C, TC, BMI	-Methodology not clear
9. Isezuo et al, 2003	Cross-sectional	Nigeria	120		Use of medications	- lipids levels -Obesity	LDL-C, HDL-C, TG, BMI	Unclear sampling method. Poorly discussed population characteristics
10. Sobngwi et al	Cross-sectional Multi centric	Tanzania, Kenya, Cameroun Ghana, Senegal, Nigeria	2352	Adult population registered for management of DM Mean age=53.0±16.0	-Medications - Treatment for hyperlipidaemia especially with Statins	-Duration of diabetes -Assessment of Cardiovascular risk factors and diabetes complications -Clinical outcomes	TC, HDL-C, TG, BMI	Lack of standardization of biological measurement Study was limited to best level of care.

Table 2: Summary of Lipid control

Ref/dates of study	Setting	Country	Sample size	Population characteristics			Lipid control indicators (Levels of TC, LDL, HDL, TG measurement) mmol/L				Process outcomes (Frequency of lipid measurement documentation)
				% Male	Age (years)		TC Mean(SD)	LDL-C Mean(SD)	HDL-C Mean(SD)	TG Mean(SD)	
					Mean (SD)	Range					
1.Gudina et al 2009	TH	Ethiopia	329	M:F 1.46:1	48.4 (15.1)	15-82					
2.Okafor/Ofoegbu, 2011	TH	Nigeria	233	42.1			5.3(1.28) >5.2=38.2%	3.12(0.9) >2.6=73.5%	1.22(0.42) <1.4=61.8%	1.56(0.81) >1.7=40%	
3.Chineye et al, 2008	TH	Nigeria	531	39.4	57.1 (12.3)		4.9(1.1)		1.2(0.6) >1.0=23.7%	<1.7= 39.3% <2.3= 45.6%	
4.Joseph et al, 2009/10	TH	Cameroun	205	43.6	57	29-85	1.82(0.46) <2.0=68.9	1.15(0.44) <1.0=38%	0.49 (0.2) <0.4=63.6%		
5.Christopher OA, 1999-2001	TH	Nigeria	218	58.7	52(5.8)	36-62	4.37(0.67) >5.17=9.2%				
6. Isezuo, 2002	TH	Nigeria	254	60.6			4.85(0.73)	2.61(0.55)	1.25(0.33)	4.38(0.99)	
7.Berhane et al-Received 2008	TH	Eritrea	429		57.4	11.8	>5.18= 43.4%	>4.17= 15.3%		>5.18= 28.2%	
8.Vezi/Naidoo 2002-2003	TH	South Africa	62		M-49 F-50	34-72 33-69	M=4.8 F=5.0	M=2.7 F=3.1	M=0.99 F=1.2 <1.03=34%	M=2.7 F=1.8	

								≥2.6=66.1%		≥1.69=57.1%	
9.Isezuo et al 2003	TH	Nigeria	120				4.36(1.32) >5.2=17.5%	2.37(1.22) >3.5=12.5%	1.20(0.55) <0.9=22.5%	1.79(0.56) >1.75=25%	Dyslipidemia=57.5%
10.Sobngwi et al 2008	Specialized Clinics	Tanzania Kenya Cameroon Ghana Senegal Nigeria	2352				4.9(1.2)		1.3(0.7)	1.2(0.7)	29% East Africa to 72% Central Africa

TC=Total Cholesterol LDL-C=Low Density Lipoprotein-Cholesterol HDL-C=Low Density Lipoprotein-Cholesterol
TG=Triglycerides SD=Standard Deviation TH=Tertiary Hospital PHC=Primary Health Centre

Process measures were infrequently reported. In one study [40], frequency of dyslipidemia was recorded in 57.5% of patients during the period of study. In another [39], frequency of lipid measurements in the previous year was 28.5% in East Africa, 72% in Central Africa, 48.2% in West Africa and 45.1% in total. Dyslipidaemia had varying definitions, and different aspects of the lipid profile were used with variations in thresholds.

Total cholesterol was most commonly used across all the studies with target levels of good control at <5.2mmol/L. However, despite the fact that this was not met in an estimated 18% to 43% of patients (in eight of the studies), the mean total cholesterol level was approximately 4-5.5 mmol/L. The mean LDL-C levels ranged from 1.15mmol/L [34] to 3.12mmol/L. Poor LDL-C control that did not meet levels of <2.6mmol/L was seen in 73.5% of patients in one study [32] and 66.1% of patients in another study [38]. The other studies had variable measures of LDL-C and target levels documented. Except for one study with mean HDL-C level of 0.49 [34], the mean HDL-C levels were from 1.0mmol/L to 1.3 mmol/L. Twenty percent to 65% of patients had less than 1.0mmol/L of HDL-C value. The target value for triglycerides of <1.7mmol/L was found in 40% to 60% of patients. The mean value for triglyceride was from 1.56mmol/L [32] to 4.38mmol/L [36].

DISCUSSION

High lipid levels directly relate to insulin resistance and hyperglycaemia. Insulin resistance and hyperglycaemia will usually lead to an overproduction of lipoproteins from the liver - especially those rich in triglyceride, decreased clearance of such lipoproteins and in some cases, altered postprandial lipoprotein metabolism. Good glyceamic control could improve lipid profile levels among type 2 diabetes patients.

This review found that lipid levels control was relatively poor for persons with type 2 diabetes in sub-Saharan Africa. This may likely be, in part, due to higher rates of poor glycemic control in this region [2]. In most studies reviewed, less than half of patients met the clinical outcomes.

From the studies, it may be inferred that lipid control was better achieved in tertiary health centers than primary health centers.

The studies were mostly cross-sectional, sometimes difficult to interpret and of low quality mainly due to methodological discrepancies and poor reporting. In settings where healthcare was still developing, multiple interventions and implementation strategies were documented. However, some of these may still have improved clinical outcomes.

Interventions and implementation strategies in Type 2 diabetes care, including lipid levels control, are generally poor and inadequate in SSA when compared to more developed societies [2]. However, considering the genetic makeup, study settings, health care facilities, differences in interventions, strategies for their implementation, clinical guidelines for management and target levels, intervention effectiveness may have varied between the regions studied. Furthermore, baseline measurements were unlikely to be equal and may have been affected by other diseases of high prevalence in these regions. This is consistent with many national guidelines that include treatment algorithms that are based on available evidence, locally available drugs, and prescribing regulations [41]. IDF's updated guideline contains a generic algorithm that has been designed for countries to adapt to their specific needs [41]. While inconsistent in this review, regular clinic visits, self-monitoring by patients and clinic records and charts may be effective measures in developed countries. In this study, poor utilisation of these interventions may have contributed to suboptimal outcomes. This review documented similar clinical outcomes to that documented in the review conducted by the Cooperation Council for the Arab States of the Gulf [42]. For example, the LDL-C levels in three studies in this review was similar in comparison to 2.6mmol/L in the Gulf.

Nonetheless, lipid levels in this review were generally higher than in some studies from the UK [43-45], the USA [46,47], and Australia [48]. It was noted that these countries have higher standards of healthcare and some clinical outcomes in this review met the UK Quality and Outcomes Framework targets[49]. Studies in other countries [43-46] documented process outcomes more frequently than those in this review. In developed societies, process measures and outcomes of diabetes, including cardiovascular risk factors and complications, can also be measured [43,46].

Despite the fact that this study did not actively look for barriers to improved care in these regions, it may suffice to say that these barriers contributed significantly to the suboptimal indicator levels found in this review. Based on the studies, these would include poor adherence to therapeutic measures, poor health seeking behaviors, poor access and affordability to quality healthcare services, ineffective use of medications and health care facilities, and difficulty with lifestyle changes. Most of these factors are related to patients. The reviewed studies indicate that clinician factors include poor patient registration, inadequate chart keeping, poor diabetes education, and oversight in testing or

managing risk factors. In contrast with other reviews discussing interventions and barriers to diabetes management [50], patients' and clinicians' attitudes and beliefs, cultural factors, and organisational factors were not explicitly discussed.

There was a major limitation to the reviewed studies due to their heterogeneity. Populations varied, as did outcome measures. Studies were conducted in different health systems with different study settings. Because there is no universally accepted definition of high-quality diabetes care and the diabetes care programmes differ widely, meaningful comparisons could not be made.

It was difficult to evaluate complex interventions and to base them on evidence. A few countries in sub-Saharan Africa were included in the review. There was no standardization of clinical outcomes in most of the studies. Most studies did not include primary prevention programmes. The studies reviewed were cross-sectional and of moderate to low quality. Many methodological discrepancies were evident. However, no study was excluded due to difficulty assessing quality. As a consequence of the low number of papers returned by the different searches in each database, fewer papers were eligible for review.

Conclusion:

Based on the findings of this review, the quality of care for type 2 diabetes based on lipid control in sub-Saharan African countries is suboptimal. Thus, this region must improve its healthcare quality. This study did not identify high quality studies, and thus assessment of their quality may have been impaired. Therefore, a higher standard of research in this region would be necessary if future research is to be of a relatively high standard.

Several interventions were identified in this study, mainly secondary prevention strategies, which may improve quality of care in this region. There is a good chance that the implementation strategies identified in this review would contribute effectively to improving quality of care.

Although there are standard international, national, and regional guidelines involved in diabetes care, there may be little or inadequate adherence to these guidelines. However, further standardization of processes and clinical outcomes based on current studies may be necessary to permit comparisons and quality of care audits.

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