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Review

Systematic review and meta-analysis of the prevalence and clinical profile of lean type 2 diabetes mellitus in Africa

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Abstract

Introduction

Lean Type 2 diabetes mellitus (T2DM), defined as individuals with body mass index (BMI)<25 kg/m^2, presents distinct clinical and biochemical characteristics across populations, particularly in Africa. This review assessed the prevalence and clinical-biochemical profiles of lean T2DM in Africa, aiming to improve understanding and management strategies.

Methods

This systematic review and meta-analysis involved 11 observational studies on lean T2DM in African adults. Specific BMI definitions [<25 Kg/m^2] and clinical parameters were assessed, while non-observational studies were excluded. Data was analysed using STATA 18.

Results

The pooled prevalence of lean T2DM in African populations was 38.5% (95% CI: 26.8%-50.9%, I2=96.71%, p<0.001]). Clinical characteristics reveal a mean age of 48.35 years and a pooled mean BMI of 25.45 kg/m^2. Metabolic assessments indicated raised HbA1c levels with a pooled median 9.34% [95%CI: 8.60–10.08%, I2=97.44%, p<0.001]). Insulin resistance was low, as indicated by HOMA2-IR levels.

Conclusions

This review revealed a high prevalence of lean T2DM in Africa and identified unique clinical and biochemical characteristics. The findings suggest a potential need for more tailored approaches in assessing this phenotype, which remains underrepresented in current guidelines. Larger, well-designed studies are needed to strengthen the evidence base and inform effective treatment strategies.

Introduction

The current burden of diabetes mellitus in Africa is 25 million people, most of which have type 2 diabetes mellitus. This burden is projected to increase by 142% to 60 million in 2050. 1 in 20 adult Africans has diabetes [1].

According to Ong et al. Age standardised diabetes DALY in Africa was 1387·6 (1247·6 to 1589·2) per 100,000 in 2021 with a percentage increase in DALY rate of 21.4% (7.9–31.6) from 1990 [2]. T2DM varies significantly in clinical presentation, pathophysiology, progression, and treatment response across different populations due to genetic and environmental factors [3]. Studies have highlighted diverse T2DM phenotypes in Asians, mixed ancestry groups, and Africans, including those with a normal or low body mass index (BMI) [4].

In addition to its traditional manifestation in obese populations, T2DM has been extensively documented in nonobese adult individuals in Sub-Saharan Africa [[5], [6], [7], [8]]. The underlying mechanisms for this atypical presentation remain unclear; however, associations have been observed with specific genetic polymorphisms and environmental factors, including early-life malnutrition (both in utero and during early childhood) and tropical infections, such as malaria and tuberculosis. The aforementioned factors contribute to epigenetic modifications that may influence the growth and, consequently, diminishing pancreatic functionality [9,10].

Lean T2DM encompasses a range of individuals, including those classified as underweight (BMI<18.5 kg/m^2) and those within the normal-weight category (BMI 18.5–24.9 kg/m^2), all of whom are affected by T2DM. Most of the research that has examined T2DM in underweight and normal-weight adult patients has been carried out within Asian Indian populations, revealing important variations [4,11,12].

Understanding these phenotypes is crucial for appropriate patient management [6,13]. A cross sectional analysis of WHO STEP surveys from 56 countries that involved 8695 new T2DM patients

indicated that the mean BMI at diagnosis was 25.2 and some of the surveys were done in African countries [14].

Observational studies in Asian populations have identified young age at onset, low BMI, reduced pancreatic beta function, metabolic syndrome markers, and elevated glycated haemoglobin as key characteristics of Lean T2DM—similar traits observed in some Black populations [8,[15], [16], [17]].

Notably, there are limited studies that characterize adult diabetic Africans with lean or normal body mass well. The limited cross-sectional and longitudinal studies done on black populations with T2DM have highlighted varying characteristics. For instance a prospective cohort study of 500 Ugandans and 714 white Europeans in UK found that early onset T2DM in Ugandans was associated with less adiposity and a greater degree of pancreatic beta dysfunction as compared with white Europeans [18,19].

The pathogenesis of T2DM in Africa is different from the traditional models as seen in White and Asian populations with poor socioeconomic status, infectious diseases such as malaria and epigenetic factors playing a bigger role [20,21]. Observational studies in Sub Saharan Africa have highlighted a distinct phenotype of T2DM associated with a lean or normal body mass, low TG/LDL ratio, low TGI as markers of low insulin resistance and reduced pancreatic beta cell function [13,15]. As highlighted in these studies, there is a special phenotype of type 2 diabetes in black Africans with lean body mass and key variations in pathogenesis, presentation, and management [22]. Available cross-sectional studies lackcomprehensive information regarding individuals' immunologic, biochemical, and clinical characteristics [[22], [23], [24], [25], [26]].

Information on lean type 2 diabetes mellitus in adult Africans is scarce, with no systematic reviews or meta-analyses available [20,23,27]. Clinically, most of the patients with T2DM in the African population are started on metformin-based regimens at initiation of therapy as indicated in ADA and NICE guidelines, yet some evidence indicates lean patients with T2DM have reduced pancreatic beta cell function at diagnosis and low degree of insulin resistance [22]. Such patients require early insulin initiation to improve glycaemic control and delay complications, but the available guidelines are suited for overweight or obese T2DM. This has been associated with clinical inertia among health care providers delaying to initiate insulin therapies in lean T2DM patients [28]. In depth studies on the influence of specific phenotypes in African population could contribute to equity of care and the existence of more effective therapies, since there is one (or more)population that requires specific therapies.

This study intended to gather data on the prevalence, clinical, and biochemical profiles of lean T2DM in Africa. This is necessary to inform policy formulation and the development of local prevention and treatment therapies for this unique T2DM population in low-income settings and the aims of the study were as follows.

To describe the prevalence of lean T2DM in Africa.

To outline the clinical characteristics of lean T2DM patients in Africa.

To outline the biochemical characteristics of lean T2DM patients in Africa.

Section snippets

Methods

This systematic review and meta-analysis was conducted in accordance with the guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol [29]. The protocol for this review was registered with PROSPERO [CRD42024580065]. …

Results

The article selection process is shown in Fig. 1 using a PRISMA flow diagram.

A comprehensive literature search yielded a total of 487 articles. A total of 131 duplicates were removed from the dataset. A review was conducted on the titles and abstracts of the remaining 356 articles, resulting in the identification of forty-six (46) articles for full-text retrieval. Out of the 46 articles assessed, 37 were excluded from the analysis, resulting in 9 articles being included in the systematic …

Discussion

According to our knowledge, this is the first systematic review to determine the prevalence of lean T2DM in Africa as well as describing the clinical and biochemical characteristics of this phenotype. …

Conclusion

This review found a high prevalence (38.5%) of lean T2DM in the African population and identified common features including markers of pancreatic hypofunction, low insulin resistance, normal lipid profile, and younger average age. While the findings highlight unique patterns, they are based on observational data and do not allow for causal inference. Further research, including large observational studies and randomized controlled trials, is needed to better characterise this phenotype and …

Statement of funding

This study did not receive any funding. …

Data availability

The studies included in this study are published and available online. No data set is available this review. …

Author contributions

NO, AW, and KR conceived the idea of conducting this review, AG performed the database search, NO, KR, and AW screened the retrieved published articles and identified the studies to include in the review, NO assessed the quality of the included studies and performed the statistical analysis, NO and AW extracted the key information of interest from the identified studies and wrote the initial draft of this manuscript, BD provided additional interpretation of the extracted data. All the authors …

CRediT authorship contribution statement

Nankunda Oreb: Writing – review & editing, Writing – original draft, Validation, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Katuramu Richard:** Writing – review & editing, Writing – original draft, Conceptualization. **Bwayo Denis:** Writing – review & editing, Writing – original draft. **Ahmed Waheed:** Supervision, Methodology, Formal analysis, Data curation, Conceptualization. …

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. …

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