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Epidemiology of Obesity and Overweight in Sub-Saharan Africa: A Protocol for a Systematic Review and Meta-Analysis

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Abstract

Introduction: Globally, overweight and obesity were estimated to cause 3.4 million deaths, 3.9% of years of life lost and 3.8% of disability adjusted life years (DALYs) in 2010. Despite the fact that obesity and overweight is a problem of high-income countries, LMICs particularly in urban settings and sub-Saharan Africa countries face the challenge with an increasing trend. The aim of this systematic review and meta-analysis study will be to determine prevalence of obesity and overweight in sub-Sahara Africa in order to guide policy planner for decision making process for non-communicable diseases rising in Africa.

Methods and analyses: A comprehensive systematic review and meta-analysis of the published and unpublished studies on prevalence of obesity and overweight in sub-Saharan Africa will be conducted. A computerized internet search using databases of MEDLINE/PUBMED, Google scholar, EMBASE, and reference lists of previous prevalence studies and detailed search-strategy and cross-checking of reference lists for published peer-reviewed articles that included will be conducted to identify all epidemiological and/or clinical data studies published in English. We will use PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) statement for reporting. The overall effect (pooled estimated effect size) of prevalence of obesity and overweight will be carried out by using the Der Simonian-Laird random-effects meta-analysis (random effects model) and measured by the level of obesity proportion with 95% confidence intervals [95%CI]. Meta-regression analysis will be used to determine potential confounders and summarize the estimates, and investigate sources of heterogeneity between studies.

Ethics and Dissemination

The underlying work is based on systematic reviews of published data, and thus did not require ethical review approval. The findings of the systematic review will be disseminated in different conferences and seminars, and also the finding will be published in a reputable and referred international peer reviewed journal.

Protocol registration number: CRD42017064942

Strengths and limitations of this study

- A comprehensive systematic review and meta-analysis of the published and unpublished studies on prevalence of obesity and overweight in sub-Saharan Africa will be included.
- All epidemiological studies of observational (cross-sectional, cohort, case-control) and randomized controlled trial will be included.
- Inclusion of a wide range of studies and settings
- Small sample size (<30 participants) and those studies conducted outside of sub-Saharan Africa will be excluded.

Introduction

Globally, overweight and obesity were estimated to cause 3.4 million deaths, 3.9% of years of life lost and 3.8% of disability adjusted life years (DALYs) in 2010[1]. Rapid rise in obesity and overweight due to nutrition alteration (fast food) and sedentary lifestyle have affected society health in unprecedented way. Obesity and overweight causes serious metabolic disorders such as diabetes, cardiovascular disease, hypertension, and cancers[2]. Change in urbanization and westernization of diets and lifestyles transform on the consumption of highly processed diet and contribute for the rising obesity, decreased physical activity, and increasing risk of metabolic and cardiovascular diseases [3]. In the same way, considerable demographic, social and economic changes have been happened in low and middle income countries(LMIC) including rapid urbanization, expanded education, increased industrialization, rising incomes in past few decades [2].

A systematic analysis of global data on the prevalence of obesity and overweight showed that the prevalence of overweight and obesity has risen significantly over the past three decades[1]. Despite the fact that obesity and overweight is a problem of high-income countries, LMICs particularly in urban settings and sub-Saharan Africa countries face the challenge with an increasing trend [4]. Evidences showed that high body mass index (BMI) in childhood is associated with increased risk of cardiovascular disease (CVD), type 2 diabetes mellitus [5, 6], hypertension[6] and contribute for becoming obese adults[7, 8]. In Africa, the number of children who are overweight or obese has nearly doubled from 5.4 million in 1990 to 10.6 million in 2014[4]. The clear picture of Obesity and overweight is that it can affect a child's immediate health, educational attainment and quality of life[9].

Establishing a monitoring systems can provide evidence of the impact and effectiveness of interventions in reducing the prevalence of obesity[9] and utility to inform policy and practice decisions on how to prevent and treat childhood obesity [10]. There is a death of epidemiological information on comprehensive summary of evidence in sub-Sahara Africa countries on the estimation of obesity and overweight. The aim of this systematic review and meta-analysis study will be to determine prevalence of obesity and overweight in sub-Sahara

Africa in order to guide policy planner for decision making process for non-communicable diseases rising in Africa.

Methods

Study design and data source

A comprehensive systematic review and meta-analysis of the published and unpublished studies on prevalence of obesity and overweight in sub-Saharan Africa will be conducted. A computerized internet search using databases of Web of Science, Medline/PubMed, Scopus, Excerpta Medica Database Guide (EMBASE) and Google scholar, and reference lists of previous prevalence studies and detailed search-strategy and cross-checking of reference lists for published peer-reviewed articles that included will be conducted to identify all epidemiological and/or clinical data studies published in English. A combination of Medical subject headings (MeSH) and key word terms used to search the database like "Obese ""obesity" , "overweight " ,"epidemiology", "prevalence" "Africa", "East Africa", "Southern Africa", " Central Africa" , " Western Africa", " children" and " adolescent (For more details see appendix 1)" which will be used as a combination of free text and thesaurus terms in different way to search the eligible articles to include. Search will also make for cross-reference lists of identified original articles and reviews for other relevant articles. We did not exclude any articles on the basis of publication date and only human studies in English will be included. The data of abstraction will be performed from May 2017 onwards. Authors will be contacted for providing additional details of information for their research depending of the circumstances. Cross reference for relevant full text articles will be hand searched for further original papers.

Study selection for inclusion in the review

Studies obtained from the literature search will be checked by title and citation. References from the selected studies will be also assessed to ensure that relevant studies will not be misplaced. Studies will be required to meet the following inclusion criteria: Reports of original studies, unpublished master's thesis and PhD dissertations written in English language and finding evaluated for prevalence of obesity and overweight and studies coming from sub-Sahara Africa setting will be also considered. Studies will be excluded from the analysis for any of the following reasons: duplicate publication of the same study; and articles available only in abstract form, letters, reviews, commentaries, editorials, case series with small sample size (<30

participants) and those studies conducted outside of sub-Saharan Africa will be excluded. The selection of articles for review will be done in three stages: titles alone, abstracts, and then full-text articles. The PRISMA flow diagram will be applied to summarize and synthesize the selection procedure and process of the articles[11].

Protocol and registration

This systematic review and meta-analysis protocol was registered with the PROSPERO International Prospective Register of Systematic Reviews (PROSPERO) (registration number: CRD42017064942). We will use Meta-analysis Of Observational Studies in Epidemiology(MOOSE) guidelines for reporting [12] and Preferred Reporting Items for Systematic reviews and Meta-Analyses(PRISMA-P) statement[13](Appendix 2).

Methodological quality assessment

Studies will be assessed for quality to be included for analysis. Methodological quality of included articles will be examined according to the Newcastle-Ottawa Scale (NOS). This tool was developed to assess the quality of nonrandomized studies [14]. The STROBE checklist will be used to evaluate the quality of reporting in each paper [15].

Data extraction and management

Data abstraction will be performed by three independently reviewers (SB, DH, KT) using a standard abstraction form which is designed for data abstraction. When there is a disagreement, the relevant paper whether met the inclusion criteria will be reviewed and differences will be resolved by consensus and through discussions. The selected studies will be reviewed to extract data about title, authors, and year of publication, study design, study setting (rural vs. urban; hospital vs. community-based), sample size, geographical region (central, eastern, southern and western Africa), data collection procedures, prevalence and its outcome. In some cases whereby the studies encompassed multiple countries, we will take the finding of the prevalence for each country accordingly.

Statistical analysis

Epi-data version 3.1 and STATA version 12 (STATA Corporation, College Station, Texas) software will be used for data entry and analysis respectively. The description of original studies will be assessed by using frequency and forest plot. The overall effect (pooled estimated effect

size) of prevalence of obesity and overweight will be carried out by using the Der Simonian-Laird random-effects meta-analysis (random effects model) and measured by the level of obesity proportion with 95% confidence intervals [95%CI].

Sub-group analysis:

Statistical heterogeneity and Exploration of Publication bias

A funnel plot will be produced to assess publication bias, with the symmetry of the plot assessed visually and Begg rank correlation, and Egger weighted regression test methods will be used to statistically assess publication bias ($p<0.05$ will be considered as indicative of statistically significant publication bias). Cumulative meta-analysis will also be used to see the effect of each study and less precise studies on the pooled estimates. Statistical heterogeneity will be assessed with Cochran's Q test ($P<0.10$ considered indicative of statistically significant heterogeneity), which tests if the amount of between study heterogeneity is greater than due to chance [] and I^2 statistic the magnitude of statistical heterogeneity that can be expected by partitioning out the chance heterogeneity (values of 25%, 50% and 75% are considered to represent low, medium and high heterogeneity respectively). Meta-regression analysis will be used to determine potential confounders such as age, sex, study population characteristics, year of study, country, end date of the study, year of publication, sample size, study design, residence (rural or urban); setting (private or public school or community), and geographical region (Central Africa, Eastern Africa, Southern Africa, and Western Africa) and summarize the estimates, and investigate sources of heterogeneity between studies will be conducted.

Ethical Clearance

The study adheres with the Declaration of Helsinki. The underlying work is based on systematic reviews of published data, and thus did not require ethical review approval.

Discussion

The study will shed a light on understanding of the epidemiology of obesity and overweight phenomena in sub-Sahara Africa. It is an imperative to highlight the slowly growing existence of obesity in the global community and in Africa in particular. As Low and middle income countries showed a nutrition transitions in the recent past, providing evidence based decision

making process for public health, nutritionist and medical practitioner above all to policy makers. While knowing the prevalence, this systematic review includes all target groups and different setting to make a comprehensive and exhaustive review and meta-analysis in the area of obesity and overweight. The findings of the systematic review will be disseminated in different conferences and seminars, and also the finding will be published in a reputable and referred international peer reviewed journal.

Funding

This review received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Availability of data and materials

Not applicable.

Authors' contributions

SB conceived designed, literature search, data extraction and analysis and drafted the protocol. TM, DH, BG conceived and designed the study, and participated in the critical revision of the manuscript. YM, KT conceived, designed, literature search, data extraction and analysis the study, data extraction and took part in the critical revision of the manuscript. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

Consent for publication

Not applicable.

Reference

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Appendix 1

Search strategy

Database(s): **Embase** 1947 to present

Search	Query
1	child*.mp.
2	adolescence/ or middle aged/
3	young adult/
4	adult/
5	1 or 2 or 3 or 4
6	obesity/
7	Overweight.mp.
8	6 or 7
9	prevalence/
10	"africa south of the sahara"/ or angola/ or benin/ or botswana/ or burkina faso/ or burundi/ or cameroon/ or cape verde/ or central africa/ or central african republic/ or chad/ or comoros/ or congo/ or cote d'ivoire/ or democratic republic congo/ or djibouti/ or equatorial guinea/ or eritrea/ or ethiopia/ or gabon/ or gambia/ or ghana/ or guinea/ or guinea-bissau/ or kenya/ or lesotho/ or liberia/ or madagascar/ or malawi/ or mali/ or mayotte/ or mozambique/ or namibia/ or niger/ or nigeria/ or rwanda/ or senegal/ or sierra leone/ or somalia/ or south africa/ or south sudan/ or sudan/ or swaziland/ or tanzania/ or togo/ or uganda/ or zambia/ or zimbabwe/
11	5 and 8 and 9 and 10

Database(s): **Medline** 1946 - present
Search Strategy:

Search	Query
1	Child/
2	Adolescent/
3	Young Adult/
4	Middle Aged/

5	Adult/
6	Obesity/
7	Overweight/
8	6 or 7
9	"africa south of the sahara"/ or africa, central/ or cameroon/ or central african republic/ or chad/ or congo/ or "democratic republic of the congo"/ or equatorial guinea/ or gabon/ or africa, eastern/ or burundi/ or djibouti/ or eritrea/ or ethiopia/ or kenya/ or rwanda/ or somalia/ or south sudan/ or sudan/ or tanzania/ or uganda/ or africa, southern/ or angola/ or botswana/ or lesotho/ or malawi/ or mozambique/ or namibia/ or south africa/ or swaziland/ or zambia/ or zimbabwe/ or africa, western/ or benin/ or burkina faso/ or cape verde/ or cote d'ivoire/ or gambia/ or ghana/ or guinea/ or guinea-bissau/ or liberia/ or mali/ or mauritania/ or niger/ or nigeria/ or senegal/ or sierra leone/ or togo/
10	Prevalence/
11	1 or 2 or 3 or 4 or 5
12	8 and 9 and 10 and 11

PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item	Page
ADMINISTRATIVE INFORMATION			
Title:			
Identification	1a	Identify the report as a protocol of a systematic review	1
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	Not applicable
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	PROSPERO CRD42017064942 2,6
Authors:			
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	1
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	8
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	Not applicable
Support:			
Sources	5a	Indicate sources of financial or other support for the review	8
Sponsor	5b	Provide name for the review funder and/or sponsor	Not applicable
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	Not applicable
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	4
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	4,5
METHODS			
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	5
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	5
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it	5 (appendix 1)

		could be repeated	
Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	6
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	5,6
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	6
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	6, 7
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	6,7
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	6,7
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	6,7
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I^2, Kendall's τ)	6,7
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	7
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	6,7
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	6,7
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	6

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

From: Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart L, PRISMA-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. BMJ. 2015 Jan 2;349(jan02 1):g7647.

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Abstract

Introduction: Globally, being overweight and obesity were estimated to cause 3.4 million deaths, 3.9% of years of life lost, and 3.8% of disability adjusted life years (DALYs) in 2010. Despite the fact that obesity and overweight is a problem of high-income countries, low and middle- income countries (LMICs) in particular, urban settings of sub-Saharan African countries face the challenge with an increasing trend. The aim of this systematic review and meta-analysis study will be to determine prevalence of obesity and overweight individuals in sub-Saharan Africa and to help guide policy planners in the decision making process for non-communicable diseases rising in Africa.

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The underlying work is based on systematic reviews of published data, and thus did not require ethical review approval. The findings of the systematic review will be disseminated in different conferences and seminars, and the findings will be published in a reputable and referred international peer reviewed journal.

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- All epidemiological studies of observational (cross-sectional, cohort, case-control) and randomized controlled trial will be included.
- Inclusion of a wide range of studies and settings
- Small sample size (<30 participants) and those studies conducted outside of sub-Saharan Africa will be excluded.

Introduction

Globally, being overweight and obesity were estimated to cause 3.4 million deaths, 3.9% of years of life lost and 3.8% of disability adjusted life years (DALYs) in 2010[1]. Obesity and overweight causes serious metabolic disorders such as diabetes, cardiovascular disease, hypertension, and cancer[2]. Rapid rise in obesity and being overweight due to nutrition alteration (fast food) and sedentary lifestyles have affected society health in an unprecedented way. Change in urbanization and westernization of diets and lifestyles modifications and the consumption of a highly processed diet contribute to the rise in obesity, decreased physical activity, and increasing risk of metabolic and cardiovascular diseases [3]. In the same way, considerable demographic, social and economic changes have been happening in low and middle income countries(LMIC) including rapid urbanization, expanded education, increased industrialization, and rising incomes in the past few decades [2].

A systematic analysis of global data on the prevalence of obesity and overweight showed that the prevalence of overweight and obesity has risen significantly over the past three decades[1]. Despite the fact that obesity and overweight is a problem of high-income countries, LMICs particularly in urban settings and sub-Saharan African countries face the challenge with an increasing trend [4]. Apparently, the fact shows that in 2014, more than 1.9 billion adults aged 18 years and older were overweight. Similarly, 13% of the world's adult population (11% of men and 15% of women) were obese in 2014[4]. In Africa, the number of children who are overweight or obese has nearly doubled from 5.4 million in 1990 to 10.6 million in 2014[4]. The clear picture of Obesity and overweight is that it can affect a child's immediate health, educational attainment, and quality of life[5]. Evidence showed that a high body mass index (BMI) in childhood is associated with increased risk of cardiovascular disease (CVD), type 2 diabetes mellitus [6, 7], hypertension [7] and contributes to becoming obese in adulthood [8, 9]. Establishing monitoring systems can provide evidence of the impact and effectiveness of interventions in reducing the prevalence of obesity [5] and utility to inform policy and practice decisions on how to prevent and treat childhood obesity [10]. There is a dearth of epidemiological information on comprehensive summary of evidence in sub-Saharan African

countries on the estimation of obesity and those overweight. The aim of this systematic review and meta-analysis study will be to determine prevalence of obesity and overweight individuals in sub-Saharan Africa in order to guide policy planners for decision making processes for non-communicable diseases rising in Africa.

Methods

Study design and data source

A comprehensive systematic review and meta-analysis of the published and unpublished studies on prevalence of obesity and overweight in sub-Saharan Africa will be conducted. A computerized internet search using databases of Web of Science, Medline/PubMed, Scopus, Excerpta Medica Database Guide (EMBASE) and Google scholar, and reference lists of previous prevalence studies based on detailed search-strategy including DHS Programme website to their search strategy (www.measuredhs.com) and cross-checking of reference lists for published peer-reviewed articles will be conducted to identify all epidemiological and/or clinical studies of obesity in sub-Saharan Africa published in English, French or other languages from 1947 to April 30, 2017. A combination of Medical Subject Headings (MeSH) and key word terms used to search the database like "Obese ",“obesity" , "overweight ” ,"body mass index", "body fat", "adiposity" , ‘body composition’, ‘body weight’, ‘percent body fat’, ‘body fat distribution’ “Africa", "East Africa", "Southern Africa", " Central Africa" , " Western Africa", " children" and " adolescent (For more details see appendix 1)" will be used as a combination of free text and thesaurus terms as a way to search the eligible articles to include in the analysis. Search will also make for cross-reference lists of identified original articles and reviews for other relevant articles. We did not exclude any articles on the basis of publication date and only human studies in English, French or other languages will be included. The data abstraction will be performed from May 1, 2017 to July 30, 2017. Authors will be contacted for providing additional details of information for their research depending on the circumstances. Cross reference for relevant full text articles will be hand searched for further original papers.

Study selection for inclusion in the review

Studies obtained from the literature search will be checked by title and citation. References from the selected studies will be also assessed to ensure that relevant studies will not be misplaced. Studies will be required to meet the following inclusion criteria: Reports of original

studies, unpublished master's thesis and PhD dissertations written in English, French or other languages and findings evaluated for prevalence of obesity and overweight and studies coming from sub-Sahara African settings will also be considered. Studies will be excluded from the analysis for any of the following reasons: duplicate publication of the same study; and articles available only in abstract form, letters, reviews, commentaries, editorials, case series with small sample size (<30 participants), studies with no appropriate BMI or BMI z score determination and those studies conducted outside of sub-Saharan Africa will be excluded. The selection of articles for review will be done in three stages: titles alone, abstracts, and then full-text articles. The PRISMA flow diagram will be applied to summarize and synthesize the selection procedure and process of the articles[11].

Protocol and registration

This systematic review and meta-analysis protocol was registered with the PROSPERO International Prospective Register of Systematic Reviews (PROSPERO) (registration number: CRD42017064942). We will use Meta-analysis Of Observational Studies in Epidemiology(MOOSE) guidelines for reporting [12] and Preferred Reporting Items for Systematic reviews and Meta-Analyses(PRISMA-P) statement[13](Appendix 2).

Methodological quality assessment

Studies will be assessed for quality to be included for analysis. Methodological quality of included articles will be examined according to the Newcastle-Ottawa Scale (NOS). This tool was developed to assess the quality of nonrandomized studies [14]. We adopted the previously used panel for quality assessment criteria for studies and each paper will be examined for quality with grading of low, medium, or high[15]. The STROBE checklist will be used to evaluate the quality of reporting in each paper [16].

Data extraction and management

Data abstraction will be performed by three independently reviewers (SB, DH, KT) using a standard abstraction form which is designed for data abstraction. When there is a disagreement, the relevant paper whether met the inclusion criteria will be reviewed and differences will be resolved by consensus and through discussions. The selected studies will be reviewed to extract data about title, authors, and year of publication, study design, study

setting (rural vs. urban; hospital vs. community-based), sample size, geographical region (central, eastern, southern and western Africa), obesity/overweight determination methodology, data collection procedures, prevalence and its outcome. In some cases, whereby the studies encompassed multiple countries, we will take the finding of the prevalence for each country accordingly.

Statistical analysis

Epi-data version 3.1 and STATA version 12 (STATA Corporation, College Station, Texas) software will be used for data entry and analysis respectively. The description of original studies will be assessed by using frequency and forest plot. The overall effect (pooled estimated effect size) of prevalence of obesity and overweight will be carried out by using the Der Simonian-Laird random-effects meta-analysis (random effects model) [17] and measured by the level of obesity proportion with 95% confidence intervals [95%CI]. Furthermore, stratified analysis will be included for rural vs. urban setting and childhood vs. adult prevalence of overweight/obesity.

Sub-group analysis:

Statistical heterogeneity and Exploration of Publication bias

A funnel plot will be produced to assess publication bias, with the symmetry of the plot assessed visually and Begg rank correlation, and Egger weighted regression test methods will be used to statistically assess publication bias ($p<0.05$ will be considered as indicative of statistically significant publication bias). Cumulative meta-analysis will also be used to see effect of each study for pooled estimates. Statistical heterogeneity will be assessed with Cochran's Q test ($P<0.10$ considered indicative of statistically significant heterogeneity), which tests that if the amount of between study heterogeneity is greater than the probability of chance [18] and I^2 statistic the magnitude of statistical heterogeneity that can be expected by partitioning out the chance heterogeneity (values of 25%, 50% and 75% are considered to represent low, medium and high heterogeneity respectively). Meta-regression analysis will be used to determine potential confounders such as age, sex, study population characteristics, year of study, country, end date of the study, year of publication, sample size, study design, residence (rural or urban); setting (private or public school or community), and geographical region

(Central Africa, Eastern Africa, Southern Africa, and Western Africa) and summarize the estimates, and investigate sources of heterogeneity between studies will be conducted.

Discussion

The study will shed a light on understanding of the epidemiology of obesity and overweight phenomena in sub-Saharan Africa. It is imperative to highlight the slowly growing existence of obesity in the global community and in Africa in particular. As Low and middle-income countries showed a transition in nutrition in the recent past, providing evidences on epidemiology of overweight and obesity helps for decision making processes to be taken by nutritionists, public health, and medical practitioners. While knowing the prevalence, this systematic review includes all target groups and different settings to make a comprehensive and exhaustive review in the area of obesity and overweight. The findings of this systematic review will be disseminated in different conferences and seminars, and the findings will be published in a reputable and referred international peer reviewed journal.

Ethics and Dissemination

The study adheres with the Declaration of Helsinki. The underlying work is based on systematic reviews of published data, and thus did not require ethical review approval. The findings of the systematic review will be disseminated in different conferences and seminars, and the findings will be published in a reputable and referred international peer reviewed journal.

Funding

This review received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Availability of data and materials

Not applicable.

Authors' contributions

SB conceived designed, literature search, data extraction and analysis and drafted the protocol. TM, DH, BG conceived and designed the study, and participated in the critical revision of the manuscript. YM, KT conceived, designed, literature search, data extraction and analysis the study, data extraction and took part in the critical revision of the manuscript. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

Consent for publication

Not applicable.

Reference

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Appendix 1

Search strategy

Database(s): **Embase** 1947 to present

Search	Query
1	child*.mp.
2	adolescence/ or middle aged/
3	young adult/
4	adult/
5	1 or 2 or 3 or 4
6	obesity/
7	Overweight.mp.
8	6 or 7
9	prevalence/
10	"africa south of the sahara"/ OR "angola" [tiab] OR " benin" [tiab] OR " botswana " [tiab] OR " burkina faso" [tiab] OR " burundi" [tiab] OR "ivory coast"[tiab] OR Cameroon [tiab] OR Central African Republic[tiab] OR Chad[tiab] OR Congo[tiab] OR Democratic Republic of the Congo[tiab] OR Equatorial Guinea[tiab] OR Gabon[tiab] OR Burundi[tiab] OR Djibouti[tiab] OR Eritrea[tiab] OR Ethiopia[tiab] OR Kenya[tiab] OR Rwanda[tiab] OR Somalia[tiab] OR Sudan[tiab] OR Tanzania[tiab] OR Uganda[tiab] OR Angola[tiab] OR Botswana[tiab] OR Lesotho[tiab] OR Malawi[tiab] OR Mozambique[tiab] OR Namibia[tiab] OR South Africa[tiab] OR Swaziland[tiab] OR Zambia[tiab] OR Zimbabwe[tiab] OR Benin[tiab] OR Burkina Faso[tiab] OR Cape Verde[tiab] OR Cote d'Ivoire[tiab] OR Gambia[tiab] OR Ghana[tiab] OR Guinea[tiab] OR Guinea-Bissau[tiab] OR Liberia[tiab] OR Mali[tiab] OR Mauritania[tiab] OR Niger[tiab] OR Nigeria[tiab] OR Senegal[tiab] OR Sierra Leone[tiab] OR Togo[tiab] OR (subsaharan[tiab] AND Africa[tiab])
11	5 and 8 and 9 and 10

Database(s): **Medline** 1946 - present
Search Strategy:

Search	Query

1	Child/
2	Adolescent/
3	Young Adult/
4	Middle Aged/
5	Adult/
6	Obesity/
7	Overweight/
8	6 or 7
9	"africa south of the sahara"/ OR "angola" [tiab] OR " benin" [tiab] OR " botswana " [tiab] OR " burkina faso" [tiab] OR " burundi" [tiab] OR "ivory coast"[tiab] OR Cameroon [tiab] OR Central African Republic[tiab] OR Chad[tiab] OR Congo[tiab] OR Democratic Republic of the Congo[tiab] OR Equatorial Guinea[tiab] OR Gabon[tiab] OR Burundi[tiab] OR Djibouti[tiab] OR Eritrea[tiab] OR Ethiopia[tiab] OR Kenya[tiab] OR Rwanda[tiab] OR Somalia[tiab] OR Sudan[tiab] OR Tanzania[tiab] OR Uganda[tiab] OR Angola[tiab] OR Botswana[tiab] OR Lesotho[tiab] OR Malawi[tiab] OR Mozambique[tiab] OR Namibia[tiab] OR South Africa[tiab] OR Swaziland[tiab] OR Zambia[tiab] OR Zimbabwe[tiab] OR Benin[tiab] OR Burkina Faso[tiab] OR Cape Verde[tiab] OR Cote d'Ivoire[tiab] OR Gambia[tiab] OR Ghana[tiab] OR Guinea[tiab] OR Guinea-Bissau[tiab] OR Liberia[tiab] OR Mali[tiab] OR Mauritania[tiab] OR Niger[tiab] OR Nigeria[tiab] OR Senegal[tiab] OR Sierra Leone[tiab] OR Togo[tiab] OR (subsaharan[tiab] AND Africa[tiab])
10	Prevalence/
11	1 or 2 or 3 or 4 or 5
12	8 and 9 and 10 and 11

PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item	Page
ADMINISTRATIVE INFORMATION			
Title:			
Identification	1a	Identify the report as a protocol of a systematic review	1
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	Not applicable
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	PROSPERO CRD42017064942 2,6
Authors:			
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	1
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	8
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	Not applicable
Support:			
Sources	5a	Indicate sources of financial or other support for the review	8
Sponsor	5b	Provide name for the review funder and/or sponsor	Not applicable
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	Not applicable
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	4
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	4,5
METHODS			
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	5
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	5
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it	5 (appendix 1)

		could be repeated	
Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	6
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	5,6
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	6
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	6, 7
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	6,7
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	6,7
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	6,7
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I^2, Kendall's τ)	6,7
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	7
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	6,7
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	6,7
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	6

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

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Epidemiology of Obesity and Overweight in Sub-Saharan Africa: A Protocol for a Systematic Review and Meta-Analysis

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Primary Subject Heading:	Nutrition and metabolism
Secondary Subject Heading:	Public health, Epidemiology, Cardiovascular medicine
Keywords:	NUTRITION & DIETETICS, PUBLIC HEALTH, Obesity, Overweight, Sub-Saharan Africa

Epidemiology of Obesity and Overweight in Sub-Saharan Africa: A Protocol for a Systematic Review and Meta-Analysis

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Abstract

Introduction: Globally, being overweight and obesity were estimated to cause 3.4 million deaths, 3.9% of years of life lost, and 3.8% of disability adjusted life years (DALYs) in 2010. Despite the fact that obesity and overweight is a problem of high-income countries, low and middle- income countries (LMICs) in particular, urban settings of sub-Saharan African countries face the challenge with an increasing trend. The aim of this systematic review and meta-analysis study will be to determine prevalence of obesity and overweight individuals in sub-Saharan Africa and to help guide policy planners in the decision making process for non-communicable diseases rising in Africa.

Methods and analyses: A comprehensive systematic review and meta-analysis of the published studies on prevalence of obesity and overweight in sub-Saharan Africa will be conducted. A computerized internet search using databases of MEDLINE/PUBMED, Google scholar, EMBASE, and reference lists of previous prevalence studies and detailed search-strategy and cross-checking of reference lists for published peer-reviewed articles that included will be conducted to identify all epidemiological and/or clinical studies published in English, French or other languages. We will use PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) statement for reporting. The overall effect (pooled estimated effect size) of prevalence of obesity and overweight will be carried out by using the Der Simonian-Laird random-effects meta-analysis (random effects model) and measured by the level of obesity proportion with 95% confidence intervals [95%CI].

Ethics and Dissemination

The underlying work is based on systematic reviews of published data, and thus did not require ethical review approval. The findings of the systematic review will be disseminated in different conferences and seminars, and the findings will be published in a reputable and referred international peer reviewed journal.

Protocol registration number: CRD42017064942

Strengths and limitations of this study

- A comprehensive systematic review and meta-analysis of the published and unpublished studies on prevalence of obesity and overweight in sub-Saharan Africa will be included.
- All epidemiological studies of observational (cross-sectional, cohort, case-control) and randomized controlled trial will be included.
- Inclusion of a wide range of studies and settings
- Small sample size (<30 participants) and those studies conducted outside of sub-Saharan Africa will be excluded.

Introduction

Globally, being overweight and obesity were estimated to cause 3.4 million deaths, 3.9% of years of life lost and 3.8% of disability adjusted life years (DALYs) in 2010[1]. Obesity and overweight causes serious metabolic disorders such as diabetes, cardiovascular disease, hypertension, and cancer[2]. Rapid rise in obesity and being overweight due to nutrition alteration (fast food) and sedentary lifestyles have affected society health in an unprecedented way. Change in urbanization and westernization of diets and lifestyles modifications and the consumption of a highly processed diet contribute to the rise in obesity, decreased physical activity, and increasing risk of metabolic and cardiovascular diseases [3]. In the same way, considerable demographic, social and economic changes have been happening in low and middle income countries(LMIC) including rapid urbanization, expanded education, increased industrialization, and rising incomes in the past few decades [2].

A systematic analysis of global data on the prevalence of obesity and overweight showed that the prevalence of overweight and obesity has risen significantly over the past three decades[1]. Despite the fact that obesity and overweight is a problem of high-income countries, LMICs particularly in urban settings and sub-Saharan African countries face the challenge with an increasing trend [4]. Apparently, the fact shows that in 2014, more than 1.9 billion adults aged 18 years and older were overweight. Similarly, 13% of the world's adult population (11% of men and 15% of women) were obese in 2014[4]. In Africa, the number of children who are overweight or obese has nearly doubled from 5.4 million in 1990 to 10.6 million in 2014[4]. The clear picture of Obesity and overweight is that it can affect a child's immediate health, educational attainment, and quality of life[5]. Evidence showed that a high body mass index (BMI) in childhood is associated with increased risk of cardiovascular disease (CVD), type 2 diabetes mellitus [6, 7], hypertension [7] and contributes to becoming obese in adulthood [8, 9]. Establishing monitoring systems can provide evidence of the impact and effectiveness of interventions in reducing the prevalence of obesity [5] and utility to inform policy and practice decisions on how to prevent and treat childhood obesity [10]. There is a dearth of epidemiological information on comprehensive summary of evidence in sub-Saharan African countries on the estimation of obesity and those overweight. The aim of this systematic review

and meta-analysis study will be to determine prevalence of obesity and overweight individuals in sub-Saharan Africa in order to guide policy planners for decision making processes for non-communicable diseases rising in Africa.

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Epi-data version 3.1 and STATA version 12 (STATA Corporation, College Station, Texas) software will be used for data entry and analysis respectively. The description of original studies will be assessed by using frequency and forest plot. The overall effect (pooled estimated effect size) of prevalence of obesity and overweight will be carried out by using the Der Simonian-Laird random-effects meta-analysis (random effects model) [17] and measured by the level of obesity proportion with 95% confidence intervals [95%CI]. Furthermore, stratified analysis will be included for rural vs. urban setting and childhood vs. adult prevalence of overweight/obesity.

Sub-group analysis:

Statistical heterogeneity and Exploration of Publication bias

A funnel plot will be produced to assess publication bias, with the symmetry of the plot assessed visually and Begg rank correlation, and Egger weighted regression test methods will be used to statistically assess publication bias ($p<0.05$ will be considered as indicative of statistically significant publication bias). Cumulative meta-analysis will also be used to see effect of each study for pooled estimates. Statistical heterogeneity will be assessed with Cochran's Q test ($P<0.10$ considered indicative of statistically significant heterogeneity), which tests that if the amount of between study heterogeneity is greater than the probability of chance [18] and I^2 statistic the magnitude of statistical heterogeneity that can be expected by partitioning out the chance heterogeneity (values of 25%, 50% and 75% are considered to represent low, medium and high heterogeneity respectively).

Discussion

The study will shed a light on understanding of the epidemiology of obesity and overweight phenomena in sub-Saharan Africa. It is imperative to highlight the slowly growing existence of obesity in the global community and in Africa in particular. As Low and middle-income countries showed a transition in nutrition in the recent past, providing evidences on epidemiology of overweight and obesity helps for decision making processes to be taken by nutritionists, public health, and medical practitioners. While knowing the prevalence, this systematic review includes all target groups and different settings to make a comprehensive and exhaustive review in the area of obesity and overweight. The findings of this systematic review will be disseminated in different conferences and seminars, and the findings will be published in a reputable and referred international peer reviewed journal.

Ethics and Dissemination

The study adheres with the Declaration of Helsinki. The underlying work is based on systematic reviews of published data, and thus did not require ethical review approval. The findings of the systematic review will be disseminated in different conferences and seminars, and the findings will be published in a reputable and referred international peer reviewed journal.

Funding

This review received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Availability of data and materials

Not applicable.

Authors' contributions

SB conceived designed, literature search, data extraction and analysis and drafted the protocol. TM, DH, BG conceived and designed the study, and participated in the critical revision of the manuscript. YM, KT conceived, designed, literature search, data extraction and analysis the study, data extraction and took part in the critical revision of the manuscript. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

Consent for publication

Not applicable.

Reference

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Appendix 1

Search strategy

Database(s): **Embase** 1947 to present

Search	Query
1	child*.mp.
2	adolescence/ or middle aged/
3	young adult/
4	adult/
5	1 or 2 or 3 or 4
6	obesity/
7	Overweight.mp.
8	body mass index
9	body fat
10	adiposity
11	Obese/
12	body composition
13	body weight
14	percent body fat
15	body fat distribution
16	6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15
17	prevalence/
18	"africa south of the sahara"/ OR "angola" [tiab] OR " benin" [tiab] OR " botswana " [tiab] OR " burkina faso" [tiab] OR " burundi" [tiab] OR "ivory coast"[tiab] OR Cameroon [tiab] OR Central African Republic[tiab] OR Chad[tiab] OR Congo[tiab] OR Democratic Republic of the Congo[tiab] OR Equatorial Guinea[tiab] OR Gabon[tiab] OR Burundi[tiab] OR Djibouti[tiab] OR Eritrea[tiab] OR Ethiopia[tiab] OR Kenya[tiab] OR Rwanda[tiab] OR Somalia[tiab] OR Sudan[tiab] OR Tanzania[tiab] OR Uganda[tiab] OR Angola[tiab] OR Botswana[tiab] OR Lesotho[tiab] OR Malawi[tiab] OR Mozambique[tiab] OR Namibia[tiab] OR South Africa[tiab] OR Swaziland[tiab] OR Zambia[tiab] OR Zimbabwe[tiab] OR Benin[tiab] OR Burkina Faso[tiab] OR Cape Verde[tiab] OR Cote d'Ivoire[tiab] OR Gambia[tiab] OR Ghana[tiab] OR Guinea[tiab] OR

	Guinea-Bissau[tiab] OR Liberia[tiab] OR Mali[tiab] OR Mauritania[tiab] OR Niger[tiab] OR Nigeria[tiab] OR Senegal[tiab] OR Sierra Leone[tiab] OR Togo[tiab] OR (subsaharan[tiab] AND Africa[tiab])
19	5 and 16 and 17 and 18

Database(s): **Medline** 1946 - present
Search Strategy:

Search	Query
1	child*.mp.
2	adolescent/ or middle aged/
3	young adult/
4	adult/
5	1 or 2 or 3 or 4
6	Obesity/
7	Overweight/
8	body mass index
9	body fat
10	adiposity
11	Obese/
12	body composition
13	body weight
14	percent body fat
15	body fat distribution
16	6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15
17	Prevalence/
18	"africa south of the sahara"/ OR "angola" [tiab] OR " benin" [tiab] OR " botswana " [tiab] OR " burkina faso" [tiab] OR " burundi" [tiab] OR "ivory coast"[tiab] OR Cameroon [tiab] OR Central African Republic[tiab] OR Chad[tiab] OR Congo[tiab] OR Democratic Republic of the Congo[tiab] OR Equatorial Guinea[tiab] OR Gabon[tiab] OR Burundi[tiab] OR Djibouti[tiab] OR Eritrea[tiab] OR Ethiopia[tiab] OR Kenya[tiab] OR Rwanda[tiab] OR Somalia[tiab] OR Sudan[tiab] OR Tanzania[tiab] OR Uganda[tiab] OR Angola[tiab] OR Botswana[tiab] OR Lesotho[tiab] OR Malawi[tiab] OR

	Mozambique[tiab] OR Namibia[tiab] OR South Africa[tiab] OR Swaziland[tiab] OR Zambia[tiab] OR Zimbabwe[tiab] OR Benin[tiab] OR Burkina Faso[tiab] OR Cape Verde[tiab] OR Cote d'Ivoire[tiab] OR Gambia[tiab] OR Ghana[tiab] OR Guinea[tiab] OR Guinea-Bissau[tiab] OR Liberia[tiab] OR Mali[tiab] OR Mauritania[tiab] OR Niger[tiab] OR Nigeria[tiab] OR Senegal[tiab] OR Sierra Leone[tiab] OR Togo[tiab] OR (subsaharan[tiab] AND Africa[tiab])
19	5 and 16 and 17 and 18

PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item	Page
ADMINISTRATIVE INFORMATION			
Title:			
Identification	1a	Identify the report as a protocol of a systematic review	1
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	Not applicable
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	PROSPERO CRD42017064942 2,6
Authors:			
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	1
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	8
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	Not applicable
Support:			
Sources	5a	Indicate sources of financial or other support for the review	8
Sponsor	5b	Provide name for the review funder and/or sponsor	Not applicable
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	Not applicable
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	4
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	4,5
METHODS			
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	5
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	5
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it	5 (appendix 1)

		could be repeated	
Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	6
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	5,6
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	6
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	6, 7
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	6,7
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	6,7
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	6,7
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I^2, Kendall's τ)	6,7
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	7
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	6,7
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	6,7
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	6

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

From: Shamseer L, Moher D, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart L, PRISMA-P Group. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. BMJ. 2015 Jan 2;349(jan02 1):g7647.

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Epidemiology of Obesity and Overweight in Sub-Saharan Africa: A Protocol for a Systematic Review and Meta-Analysis

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Primary Subject Heading:	Nutrition and metabolism
Secondary Subject Heading:	Public health, Epidemiology, Cardiovascular medicine
Keywords:	NUTRITION & DIETETICS, PUBLIC HEALTH, Obesity, Overweight, Sub-Saharan Africa

Epidemiology of Obesity and Overweight in Sub-Saharan Africa: A Protocol for a Systematic Review and Meta-Analysis

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Abstract

Introduction: Globally, being overweight and obesity were estimated to cause 3.4 million deaths, 3.9% of years of life lost, and 3.8% of disability adjusted life years (DALYs) in 2010. Despite the fact that obesity and overweight is a problem of high-income countries, low and middle- income countries (LMICs) in particular, urban settings of sub-Saharan African countries face the challenge with an increasing trend. The aim of this systematic review and meta-analysis study will be to determine prevalence of obesity and overweight individuals in sub-Saharan Africa and to help guide policy planners in the decision making process for non-communicable diseases rising in Africa.

Methods and analyses: A comprehensive systematic review and meta-analysis of the published studies on prevalence of obesity and overweight in sub-Saharan Africa will be conducted. A computerized internet search using databases of MEDLINE/PUBMED, Google scholar, EMBASE, and reference lists of previous prevalence studies and detailed search-strategy and cross-checking of reference lists for published peer-reviewed articles that included will be conducted to identify all epidemiological and/or clinical studies published in English and French. We will use PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) statement for reporting. The overall effect (pooled estimated effect size) of prevalence of obesity and overweight will be carried out by using the Der Simonian-Laird random-effects meta-analysis (random effects model) and measured by the level of obesity proportion with 95% confidence intervals [95%CI].

Ethics and Dissemination

The underlying work is based on systematic reviews of published data, and thus did not require ethical review approval. The findings of the systematic review will be disseminated in different conferences and seminars, and the findings will be published in a reputable and referred international peer reviewed journal.

Protocol registration number: CRD42017064942

Strengths and limitations of this study

- A comprehensive systematic review and meta-analysis of published studies on prevalence of obesity and overweight in sub-Saharan Africa will be included.
- All epidemiological studies of observational (cross-sectional, cohort, case-control) and randomized controlled trial will be included.
- Inclusion of a wide range of studies and settings
- Small sample size (<30 participants) and those studies conducted outside of sub-Saharan Africa will be excluded.

Introduction

Globally, being overweight and obesity were estimated to cause 3.4 million deaths, 3.9% of years of life lost and 3.8% of disability adjusted life years (DALYs) in 2010[1]. Obesity and overweight causes serious metabolic disorders such as diabetes, cardiovascular disease, hypertension, and cancer[2]. Rapid rise in obesity and being overweight due to nutrition alteration (fast food) and sedentary lifestyles have affected society health in an unprecedented way. Change in urbanization and westernization of diets and lifestyles modifications and the consumption of a highly processed diet contribute to the rise in obesity, decreased physical activity, and increasing risk of metabolic and cardiovascular diseases [3]. In the same way, considerable demographic, social and economic changes have been happening in low and middle income countries(LMIC) including rapid urbanization, expanded education, increased industrialization, and rising incomes in the past few decades [2].

A systematic analysis of global data on the prevalence of obesity and overweight showed that the prevalence of overweight and obesity has risen significantly over the past three decades[1]. Despite the fact that obesity and overweight is a problem of high-income countries, LMICs particularly in urban settings and sub-Saharan African countries face the challenge with an increasing trend [4]. Apparently, the fact shows that in 2014, more than 1.9 billion adults aged 18 years and older were overweight. Similarly, 13% of the world's adult population (11% of men and 15% of women) were obese in 2014[4]. In Africa, the number of children who are overweight or obese has nearly doubled from 5.4 million in 1990 to 10.6 million in 2014[4]. The clear picture of Obesity and overweight is that it can affect a child's immediate health, educational attainment, and quality of life[5]. Evidence showed that a high body mass index (BMI) in childhood is associated with increased risk of cardiovascular disease (CVD), type 2 diabetes mellitus [6, 7], hypertension [7] and contributes to becoming obese in adulthood [8, 9]. Establishing monitoring systems can provide evidence of the impact and effectiveness of interventions in reducing the prevalence of obesity [5] and utility to inform policy and practice decisions on how to prevent and treat childhood obesity [10]. There is a dearth of epidemiological information on comprehensive summary of evidence in sub-Saharan African countries on the estimation of obesity and those overweight. The aim of this systematic review

and meta-analysis study will be to determine prevalence of obesity and overweight individuals in sub-Saharan Africa in order to guide policy planners for decision making processes for non-communicable diseases rising in Africa.

Methods

Study design and data source

A comprehensive systematic review and meta-analysis of published studies on prevalence of obesity and overweight in sub-Saharan Africa will be conducted. A computerized internet search using databases of Web of Science, Medline/PubMed, Scopus, Excerpta Medica Database Guide (EMBASE) and Google scholar, and reference lists of previous prevalence studies based on detailed search-strategy including DHS Programme website to their search strategy (www.measuredhs.com) and cross-checking of reference lists for published peer-reviewed articles will be conducted to identify all epidemiological and/or clinical studies of obesity in sub-Saharan Africa published in English, French from 1947 to September 30, 2017. A combination of Medical Subject Headings (MeSH) and key word terms used to search the database like "Obese ",“obesity" , "overweight ” ,"body mass index", "body fat", "adiposity" , ‘body composition’, ‘body weight’, ‘percent body fat’, ‘body fat distribution’ “Africa", "East Africa", "Southern Africa", " Central Africa" , " Western Africa", " children" and " adolescent (For more details see appendix 1)" will be used as a combination of free text and thesaurus terms as a way to search the eligible articles to include in the analysis. Search will also make for cross-reference lists of identified original articles and reviews for other relevant articles. We did not exclude any articles on the basis of publication date and only human studies in English and French will be included. The data abstraction will be performed from May 1, 2017 to July 30, 2017. Authors will be contacted for providing additional details of information for their research depending on the circumstances. Cross reference for relevant full text articles will be hand searched for further original papers.

Study selection for inclusion in the review

Studies obtained from the literature search will be checked by title and citation. References from the selected studies will be also assessed to ensure that relevant studies will not be misplaced. Studies will be required to meet the following inclusion criteria: Reports of original studies written in English and French with their findings evaluated for prevalence of obesity and

overweight and studies coming from sub-Sahara African settings will also be considered. All epidemiological studies of observational (cross-sectional, cohort, case-control) and randomized controlled trial will be included. The papers will also been included both community and institutional based studies. Studies will be excluded from the analysis for any of the following reasons: duplicate publication of the same study; and articles available only in abstract form, letters, reviews, commentaries, editorials, case series with small sample size (<30 participants), studies with no appropriate BMI or BMI z score determination and those studies conducted outside of sub-Saharan Africa will be excluded. The selection of articles for review will be done in three stages: titles alone, abstracts, and then full-text articles. The PRISMA flow diagram will be applied to summarize and synthesize the selection procedure and process of the articles[11]. . Obesity and overweight will be defined in this study based on body mass index cut-off value from any of the established standard definition for child overweight and obesity measurement: Centers for Disease Control and Prevention (CDC)[12], International Obesity Task Force (IOTF)[13] and The World Health Organization (WHO)[14].

Protocol and registration

This systematic review and meta-analysis protocol was registered with the PROSPERO International Prospective Register of Systematic Reviews (PROSPERO) (registration number: CRD42017064942). We will use Meta-analysis Of Observational Studies in Epidemiology(MOOSE) guidelines for reporting [15] and Preferred Reporting Items for Systematic reviews and Meta-Analyses(PRISMA-P) statement[16](Appendix 2).

Methodological quality assessment

Studies will be assessed for quality to be included for analysis. Methodological quality of included articles will be examined according to the Newcastle-Ottawa Scale (NOS). This tool was developed to assess the quality of nonrandomized studies [17]. We adopted the previously used panel for quality assessment criteria for studies and each paper will be examined for quality with grading of low, medium, or high[18] and medium and high-quality studies will be included in this meta-analyses. Later, pooled prevalence will be calculated as a weighted mean among all the study estimates. The STROBE checklist will be used to evaluate the quality of reporting in each paper [19].

Data extraction and management

Data abstraction will be performed by three independently reviewers (SB, DH, KT) using a standard abstraction form which is designed for data abstraction. When there is a disagreement, the relevant paper whether met the inclusion criteria will be reviewed and differences will be resolved by consensus and through discussions. The selected studies will be reviewed to extract data about title, authors, and year of publication, study design, study setting (rural vs. urban; hospital vs. community-based), sample size, geographical region (central, eastern, southern and western Africa), obesity/overweight determination methodology, data collection procedures, prevalence and its outcome. In some cases, whereby the studies encompassed multiple countries, we will take the finding of the prevalence for each country accordingly.

Statistical analysis

Epi-data version 3.1 and STATA version 12 (STATA Corporation, College Station, Texas) software will be used for data entry and analysis respectively. The description of original studies will be assessed by using frequency and forest plot. The overall effect (pooled estimated effect size) of prevalence of obesity and overweight will be carried out by using the Der Simonian-Laird random-effects meta-analysis (random effects model) [20] and measured by the level of obesity proportion with 95% confidence intervals [95%CI]. Furthermore, stratified analysis will be included for rural vs. urban setting and childhood vs. adult prevalence of overweight/obesity.

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Statistical heterogeneity and Exploration of Publication bias

A funnel plot will be produced to assess publication bias, with the symmetry of the plot assessed visually and Begg rank correlation, and Egger weighted regression test methods will be used to statistically assess publication bias ($p<0.05$ will be considered as indicative of statistically significant publication bias). Cumulative meta-analysis will also be used to see effect of each study for pooled estimates. Statistical heterogeneity will be assessed with Cochran's Q test ($P<0.10$ considered indicative of statistically significant heterogeneity), which tests that if the amount of between study heterogeneity is greater than the probability of chance [21] and

I^2 statistic the magnitude of statistical heterogeneity that can be expected by partitioning out the chance heterogeneity (values of 25%, 50% and 75% are considered to represent low, medium and high heterogeneity respectively). We will use τ^2 to estimate the total amount of heterogeneity[22].

Discussion

The study will shed a light on understanding of the epidemiology of obesity and overweight phenomena in sub-Saharan Africa. It is imperative to highlight the slowly growing existence of obesity in the global community and in Africa in particular. As Low and middle-income countries showed a transition in nutrition in the recent past, providing evidences on epidemiology of overweight and obesity helps for decision making processes to be taken by nutritionists, public health, and medical practitioners. While knowing the prevalence, this systematic review includes all target groups and different settings to make a comprehensive and exhaustive review in the area of obesity and overweight. The findings of this systematic review will be disseminated in different conferences and seminars, and the findings will be published in a reputable and referred international peer reviewed journal.

Ethics and Dissemination

The study adheres with the Declaration of Helsinki. The underlying work is based on systematic reviews of published data, and thus did not require ethical review approval. The findings of the systematic review will be disseminated in different conferences and seminars, and the findings will be published in a reputable and referred international peer reviewed journal.

Funding

This review received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Availability of data and materials

Not applicable.

Authors' contributions

SB conceived designed, literature search, data extraction and analysis and drafted the protocol. TM, DH, BG conceived and designed the study, and participated in the critical revision of the manuscript. YM, KT conceived, designed, literature search, data extraction and analysis the study, data extraction and took part in the critical revision of the manuscript. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

Consent for publication

Not applicable.

Reference

1. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, Mullany EC, Biryukov S, Abbafati C, Abera SF *et al*: **Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: a systematic analysis for the Global Burden of Disease Study 2013**. *Lancet (London, England)* 2014, **384**(9945):766-781.
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Appendix 1

Search strategy

Database(s): **Embase** 1947 to present

Search	Query
1	child*.mp.
2	adolescence/ or middle aged/
3	young adult/
4	adult/
5	1 or 2 or 3 or 4
6	obesity/
7	Overweight.mp.
8	body mass index
9	body fat
10	adiposity
11	Obese/
12	body composition
13	body weight
14	percent body fat
15	body fat distribution
16	6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15
17	prevalence/
18	"africa south of the sahara"/ OR "angola" [tiab] OR " benin" [tiab] OR " botswana " [tiab] OR " burkina faso" [tiab] OR " burundi" [tiab] OR "ivory coast"[tiab] OR Cameroon [tiab] OR Central African Republic[tiab] OR Chad[tiab] OR Congo[tiab] OR Democratic Republic of the Congo[tiab] OR Equatorial Guinea[tiab] OR Gabon[tiab] OR Burundi[tiab] OR Djibouti[tiab] OR Eritrea[tiab] OR Ethiopia[tiab] OR Kenya[tiab] OR Rwanda[tiab] OR Somalia[tiab] OR Sudan[tiab] OR Tanzania[tiab] OR Uganda[tiab] OR Angola[tiab] OR Botswana[tiab] OR Lesotho[tiab] OR Malawi[tiab] OR Mozambique[tiab] OR Namibia[tiab] OR South Africa[tiab] OR Swaziland[tiab] OR Zambia[tiab] OR Zimbabwe[tiab] OR Benin[tiab] OR Burkina Faso[tiab] OR Cape Verde[tiab] OR Cote d'Ivoire[tiab] OR Gambia[tiab] OR Ghana[tiab] OR Guinea[tiab] OR

	Guinea-Bissau[tiab] OR Liberia[tiab] OR Mali[tiab] OR Mauritania[tiab] OR Niger[tiab] OR Nigeria[tiab] OR Senegal[tiab] OR Sierra Leone[tiab] OR Togo[tiab] OR (subsaharan[tiab] AND Africa[tiab])
19	5 and 16 and 17 and 18

Database(s): **Medline** 1946 - present
Search Strategy:

Search	Query
1	child*.mp.
2	adolescent/ or middle aged/
3	young adult/
4	adult/
5	1 or 2 or 3 or 4
6	Obesity/
7	Overweight/
8	body mass index
9	body fat
10	adiposity
11	Obese/
12	body composition
13	body weight
14	percent body fat
15	body fat distribution
16	6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15
17	Prevalence/
18	"africa south of the sahara"/ OR "angola" [tiab] OR " benin" [tiab] OR " botswana " [tiab] OR " burkina faso" [tiab] OR " burundi" [tiab] OR "ivory coast"[tiab] OR Cameroon [tiab] OR Central African Republic[tiab] OR Chad[tiab] OR Congo[tiab] OR Democratic Republic of the Congo[tiab] OR Equatorial Guinea[tiab] OR Gabon[tiab] OR Burundi[tiab] OR Djibouti[tiab] OR Eritrea[tiab] OR Ethiopia[tiab] OR Kenya[tiab] OR Rwanda[tiab] OR Somalia[tiab] OR Sudan[tiab] OR Tanzania[tiab] OR Uganda[tiab] OR Angola[tiab] OR Botswana[tiab] OR Lesotho[tiab] OR Malawi[tiab] OR

	Mozambique[tiab] OR Namibia[tiab] OR South Africa[tiab] OR Swaziland[tiab] OR Zambia[tiab] OR Zimbabwe[tiab] OR Benin[tiab] OR Burkina Faso[tiab] OR Cape Verde[tiab] OR Cote d'Ivoire[tiab] OR Gambia[tiab] OR Ghana[tiab] OR Guinea[tiab] OR Guinea-Bissau[tiab] OR Liberia[tiab] OR Mali[tiab] OR Mauritania[tiab] OR Niger[tiab] OR Nigeria[tiab] OR Senegal[tiab] OR Sierra Leone[tiab] OR Togo[tiab] OR (subsaharan[tiab] AND Africa[tiab])
19	5 and 16 and 17 and 18

PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item	Page
ADMINISTRATIVE INFORMATION			
Title:			
Identification	1a	Identify the report as a protocol of a systematic review	1
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	Not applicable
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	PROSPERO CRD42017064942 2,6
Authors:			
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	1
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	8
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	Not applicable
Support:			
Sources	5a	Indicate sources of financial or other support for the review	8
Sponsor	5b	Provide name for the review funder and/or sponsor	Not applicable
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	Not applicable
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	4
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	4,5
METHODS			
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	5
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	5
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it	5 (appendix 1)

		could be repeated	
Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	6
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	5,6
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	6
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	6, 7
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	6,7
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	6,7
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	6,7
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I^2, Kendall's τ)	6,7
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	7
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	6,7
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	6,7
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	6

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

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