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# DIET QUALITY, FOOD INSECURITY AND RISK OF CARDIOVASCULAR DISEASES AMONG ADULTS LIVING WITH HIV/AIDS: A SCOPING REVIEW PROTOCOL



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# TITLE: DIET QUALITY, FOOD INSECURITY AND RISK OF CARDIOVASCULAR DISEASES AMONG ADULT LIVING WITH HIV/AIDS: A SCOPING REVIEW PROTOCOL

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## ABSTRACT

**Introduction:** Cardiovascular diseases are the single greatest contributor to global mortality. The successful introduction and scale up of antiretroviral therapy delivered a reduction in HIV mortality but was followed by an increased prevalence of comorbidities. A higher quality diet can delay or prevent the onset of comorbidities related to HIV infection. Diet quality is the degree to which food consumption conform with dietary guidelines within a defined context. Food security is related to diet quality. Diet quality and its measures are not fully established among PLWH. This review aims to identify the diet quality and food insecurity indices that have been used among PLWH and how these constructs are associated with risk of developing cardiovascular diseases.

**Methods and analysis:** The framework recommended by Arksey and O'Malley and the Joanna Briggs Institute's (JBI) manual for review authors will be adopted for this review. The Preferred Reporting Items for Systematic review and Meta-Analyses extension for Scoping Reviews guidelines will also be duly utilized. A search strategy will be developed using keywords related to the topic. The search will be conducted on PubMed, EbscoHost, Scopus, Web of Science and COCHRANE library databases. Titles and abstracts of retrieved records will be screened independently by two reviewers. Data will be extracted from records that meet the inclusion criteria using a predesigned charting tool. Discrepancies in decisions made by reviewers will be resolved by consensus or the decision of a third reviewer. Extracted data will be presented in tables or charts in line with the review questions. A descriptive summary of the charts or tables will follow

**Ethics and dissemination:** Ethical approval is not required for a scoping review. It will be submitted as part of the dissertation for a Master degree, and findings will be presented at conferences and published in peer review journals.

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**Keywords:** HIV infections, diet quality, food insecurity, cardiovascular diseases

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- This scoping review will be the first review to identify the current diet quality and food security status of PLWH and the association with risk for developing cardiovascular diseases.

- This review will indicate the extent to which diet quality and food security have been explored among PLWH while providing an overview of the variety of tools that have been used to evaluate these constructs.
- The insights gained will inform future research questions.
- The scoping review will be based on a comprehensive search strategy that was designed in collaboration with a research librarian and includes sources from seven databases and the grey literature.
- No meta-analysis of data or qualitative evaluation of included studies will be conducted for this review

## INTRODUCTION

Globally, cardiovascular diseases are the highest cause of death,[1], and 1.13 billion people have been reported to suffer from hypertension worldwide,[2]. Hypertension, diabetes, and dyslipidemia have been listed as the principal risk factors for cardiovascular diseases,[3]. Early recognition and treatment of the modifiable and intermediate risk factors for cardiovascular disease can significantly reduce its burden,[1].

The successful introduction and scale-up of effective Highly Active Antiretroviral Therapy (HAART) brought a reduction in the rate of HIV mortality and together with a reducing incidence rate, resulted in an ageing cohort of people living with HIV (PLWH),[4, 5]. This, however was followed by a higher risk of morbidity,[6, 7], and increased comorbidities including obesity, dyslipidemia, hypertension, and other cardiovascular diseases among PLWH,[6]. Furthermore, other intermediate risk factors such as lipodystrophy, increased central adiposity, insulin resistance, and diabetes have also been linked with the use of HAART,[8, 9].

A systematic review reported a three-fold increase in global burden of HIV-related cardiovascular disease in the last two decades. The study concluded that PLWH were twice as likely to develop cardiovascular diseases than,[10]. HIV infection and HAART use have, therefore, been reported to significantly increase the risk for cardiovascular disease,[11, 12].

Apart from HAART, poor weight status perception or body dissatisfaction may also increase the risk of cardiovascular diseases in PLWH. Researchers conducting qualitative investigation in KwaZulu-Natal, South Africa reported that urban women with non-communicable diseases such as type 2 diabetes and obesity and living in an area of high HIV prevalence mostly underestimate their body weight status. A barrier to adequate weight management may be mediated by their perception of being normal or underweight when their actual body weight is classified as overweight or obese,[13]. Other factors lifestyle factors such as dietary intake, smoking and physical activity,[14].

Similar to the general population,[15-17], lifestyle modification is an essential first step in the management of cardiovascular diseases among PLWH. Dietary interventions have been demonstrated to reduce the risk of cardiovascular diseases in the HIV-uninfected population,[18]. On this premise, and in the absence of HIV-specific dietary recommendation,[19], international guidelines have suggested adherence to the American College of Cardiology and American Heart Association (ACC/AHA) dietary guidelines for the management of cardiovascular diseases among PLWH,[16, 20].

**Diet Quality**

Diet quality is a concept that is not clearly defined; no consensus has been reached to have a specific meaning that can be applied in all contexts,[21]. However, across all sources of evidence and publications, it is a term which generally refers to how much an individual or population's food consumption conforms to dietary guidelines and recommendations within a context. Diet quality is being increasingly adopted in nutritional epidemiology surveys to assess dietary patterns and evaluate the effectiveness of a specific dietary intervention. Since a relationship has been established and understood between food and human physiological function, diet quality has also been used as a proxy to predict mortality and risk of chronic diseases,[21]. Diet quality has been measured in diverse ways. Some studies have assessed and compared the intake of a specific nutrient or food components with recommended dietary standards or guidelines,[22, 23]. Nutrition professionals, however, agreed that overall dietary pattern or the consumption of food groups is a better indication of diet quality rather than a single nutrient intake,[24]. Diet quality indices were, therefore, designed as a tool to connect food and nutrient intake to the incidence of chronic diseases, mortality, and morbidity,[24]. Most epidemiological studies have, since then, measured diet quality using scientifically robust indices enabling standardized assessment,[21, 25, 26].

Diet quality Indices

Several diet quality indices have been developed and used over the years. Some were used to evaluate adherence to dietary guidelines while others monitor changes in dietary patterns over time,[26]. Diet quality indices have also been used to identify unfavourable patterns of intake,[27]. Components assessed in diet quality indices include intake of specific macro or micronutrients, adherence to recommended serving sizes of food groups, or inclusion of predefined healthy food items,[21, 27]. In summary, diet quality has been used to measure both inclusion of specific foods and nutrients, and variety of diet.

Examples of diet quality indices include:

- Healthy Eating Index (HEI) which was designed based on the Dietary Guidelines for Americans and other dietary patterns set by the United States Department of Agriculture (USDA),[28-30].
- Mediterranean Diet Score (MDS) assessing degree of adherence to Mediterranean dietary guidelines among adults including the elderly,[31].
- Diet Quality Index (DQI) designed to reflect risk of common diet-related diseases,[32], further updated and renamed as Diet Quality Index-International (DQI-I),[33].
- Recommended Food Score (RFS) which contains 23 food items and measures overall food quality,[34].
- Dietary Diversity Score (DDS),[35] and Food Variety Score (FVS),[36] which are the total count of food groups and food items consumed respectively by a unit of population (household or individual) over a specified period of time. This does not put into account the quantity of food or food groups.
- Dietary Approaches to Stop Hypertension (DASH) diet score which is based on eight food and nutrient components and high in fruits and vegetables,[37].
- Dietary Inflammatory Index (DII) which predicts level of inflammatory markers and their outcome on health,[38].

Due to the complex and dynamic nature of diet quality, several reviews investigating associations between diet quality indices and disease risks have been conducted in the general population,[25-27, 39-41]. Poor diet quality increases the risk of mortality and morbidity in the HIV-uninfected population,[42], Some studies have also evaluated diet quality among PLWH,[6, 43-49]. Researchers from Boston in the United States conducted a cross-sectional study using the HEI tool, and reported that diet quality was lower among PLWH and significantly lower among women living with HIV when compared to HIV-negative controls,[6]. This study did not link results with risk of cardiovascular disease.

**Food insecurity**

Food insecurity is defined as limited availability of and access to sufficient, safe, and nutritious food to support healthy living,[50, 51]. The Food and Agriculture Organization (FAO), in the most recent report on the state of global food security and nutrition, estimated that 690 million people are hungry, equivalent to 8.9 percent of the world population. Since 2014, an additional 60 million people have been affected by hunger. It is projected that the total number may increase to 840 million people by 2020 if this trend continues,[52]. The FAO projects that the Covid-19 pandemic will exacerbate global food insecurity through disrupting social and

economic systems, potentially resulting in up to an additional 132 million people experiencing undernutrition in 2020,[52]. Socioeconomic factors such as food insecurity can influence diet quality. Muhammad et al. [53] reported that 55% of their sample of PLWH in the USA (aged 50 years and older) are food insecure, and that food insecurity was linked to lower diet quality, irrespective of income,[53]. This finding is supported by evidence in the general population,[54], and corroborated by the FAO report,[44].

Given the current food security situation, it is thus necessary to include food insecurity measures as a proxy to diet quality in our review.

Measures of Food Security

Food security has been assessed by several indicators at national, household, and individual levels. Some indicators measure food consumption adequacy while others gather additional information on experiences and behavioural responses,[55]. There have been several paradigms in the concept of food security which have influenced the formulation of new indices. Focus has shifted from global and national food security measures alone to include additional household and individual measures,[56].

Food security indicators may include:

- Food Consumption Score (FCS) which is used to assess food security and vulnerability by the World Food Program,[57].
- Household Dietary Diversity Score (HDDS) which is seen as the simplest possible measure at the household level,[58].
- Household Food Security Survey Module (HFSSM) developed by the United States Department of Agriculture (USDA),[59].
- Household Food Insecurity Access Scale,[50] used by the Food and Nutrition Technical Assistance-II (FANTA-II) initiative,[55].
- Food Insecurity Experience Scale (FIES) developed by FAO[60].

The extent to which diet quality has been assessed in the context of HIV is not known. The importance of diet quality in the prevention and management of cardiovascular diseases cannot be overemphasized. This scoping review is necessary to aggregate information on the depth of research on diet quality and HIV.

**Aims**

The aims of this review include:

- To determine the diet quality and food security status of adults living with HIV and the association with increased risk of cardiovascular diseases.

- To identify the range and utility of diet quality and food security indices among adults living with HIV

## METHODS AND ANALYSIS

The use of scoping reviews to synthesize evidence has increased over the years. As with other forms of literature reviews, they serve general functions of collection, evaluation, and presentation of available research evidence,[61]. Scoping reviews can also be termed "scoping studies" and "mapping reviews",[62, 63].

There are several reasons why conducting a scoping review is appropriate to answer our research aims. The scoping review could be a step leading to a full systematic review,[64]. In this case, it will identify the feasibility of a systematic review and meta-analysis, the availability of sources of evidence, and previous systematic reviews that have been conducted,[61]. Scoping reviews are also conducted as a stand-alone study to investigate the current state of knowledge or types of evidence available on a particular topic,[61], as well as illuminating knowledge gaps,[64, 65]. Furthermore, scoping reviews can summarize how research is conducted in a field of interest,[64]; appropriate study populations, research designs, and tools can be identified,[65]. Finally, key concepts and their definitions can also be identified,[64]. These concepts can be classified based on how they relate; their similarities and differences can be identified and yield a "concept map",[65]. An example of a recent scoping review explained the concept of formative peer assessment in a healthcare education programme,[66].

Scoping reviews are useful when the field of study is broadly heterogeneous,[66]; diet quality has different indices that are broadly used to appraise various components of dietary intake. Similarly, food security has been measured using a variety of indices. This review will specifically provide a summary of the extent to which diet quality and food security have been explored among PLWH while identifying tools that have been used to evaluate these constructs. Given the emerging concerns of risks of cardiovascular diseases among PLWH, we will identify how much of this concept has been explored within the context of diet quality and food security. This could identify grey areas among these concepts of diet quality, food insecurity, and risks of cardiovascular diseases among PLWH, and potentially inform areas for future research. All the above reasons justify the use of scoping review methodology for this study, [61-65, 67].

The methodology proposed by Arksey and O'Malley,[61] will form the bedrock for this scoping review. Input from the Levac, Colquhoun [68], Peters, Godfrey [69] will also be

incorporated. The JBI manual recommends that a protocol stating a stepwise approach to the scoping review be designed and that a set of criteria for including or excluding studies should be determined *a priori.* These criteria must reflect the aim as well as the questions of the review,[70].

The framework proposed by Arksey and O'Malley consists of six stages of which five are mandatory. The stages are:

1. Identifying a research question;
2. Identifying relevant studies;
3. Study selection;
4. Charting the data;
5. Collating, summarizing and reporting the result;
6. Consultation exercise (optional).

Stage six will be omitted as this scoping review is not intended to provide evidence to inform clinical decisions. It will however provide an overview of the literature on dietary components related to risks of cardiovascular diseases in PLWH and give an indication whether the type of data is appropriate for meta-analyses. Given the increased risk of cardiovascular disease in PLWH, this review will also inform how best to assess dietary intake in this cohort.

**Stage 1: Identifying the review question**

Common to all review methodologies, scoping reviews start with the formulation of a well-defined research topic that helps to clarify the search strategy,[71]. Guidelines recommend a broad approach to develop a scoping review question, enabling generation of the required depth,[61]. A review question should identify the population, concept, and context (PCC) of the study, as recommended by the JBI,[69].

This review will be carried out to map the breadth of research on diet quality, food security, and risk of cardiovascular diseases among PLWH. The primary review question is:

- What is the current diet quality and food insecurity status of adults living with HIV at increased risk of cardiovascular diseases?

The introduction of highly active antiretroviral therapy (HAART) in the late 1990s,[72] brought a significant change to the health outcomes of PLWH,[73]. The word "current" has been included as studies published since 1998 will be considered for the purpose of this scoping review. This time-period has been selected based on the recorded time for the global scale-up of HAART.

In addition to the main question this scoping review also seeks to answer the following secondary questions:

- What methodologies have been used to assess the dietary quality and food security of adults living with HIV?

**Stage 2: Identifying relevant studies**

A scoping review should exhaustively include all sources of evidence, published, or unpublished that can provide insights into the research question,[61]. The JBI recommends a three-stage systematic approach for scoping reviews. This ensures all published and unpublished sources of evidence are captured,[69]. The first stage is a preliminary search of at least two databases to identify and analyze keywords, text words, index terms and Medical Subject Headings (MeSH) terms related to the search. This was completed on MEDLINE (PubMed) and CINAHL (EBSCOhost) as recommended,[69].

In the second stage, a full and comprehensive search strategy was developed from the information retrieved and modified to suit each database. The databases that will be searched include, Medline (via PubMed), Africa wide, CINAHL, APA Psyc info (via EBSCOhost), Scopus, Web of Science, COCHRANE library, and databases for grey literature such as ProQuest and AHRQ Agency for Healthcare Research and Quality. Table 1 contains an example of a preliminary full search strategy for PubMed.

Table 1: Full search strategy for MEDLINE conducted on 11/11/2020

| # | Searches | Records retrieved |
|---|---|---|
| 1 | (((HIV positive OR Human Immuno Deficiency Virus OR People Living with HIV OR PLWH OR PLWHA OR PLWHIV OR PLHIV OR AIDS OR HAART OR Highly Active Antiretroviral OR ART OR Antiretrovirals OR Antiretroviral Therapy) OR (HIV infections[MeSH Terms])) OR (HIV[MeSH Terms])) OR (antiretroviral therapy, highly active[MeSH Terms]) | 595,201 |
| 2 | (Diet quality OR Mediterranean Diet Score OR MDS OR Healthy Eating Index score OR HEI OR DASH diet score OR Diet Quality Index score OR DQI OR Diet Diversity Score OR Dietary Diversity OR DDS OR Food Insecurity) OR (Diet[MeSH Terms]) | 365,364 |
| 3 | ((((Blood pressure OR High blood pressure OR Lipid Profile OR Hyperlipidemia OR Dyslipidemia OR Hypercholesterolemia OR Hyperglyceridemia OR Low HDL Cholesterol OR Low High-Density Lipoprotein OR Elevated LDL Cholesterol OR Elevated Low-Density Lipoprotein OR Cardiovascular disease OR Hypertension) OR (Blood Pressure[MeSH Terms])) OR (Hypertension[MeSH Terms])) OR (Dyslipidemia[MeSH Terms])) OR (Cardiovascular disease[MeSH Terms]) | 3,208,278 |
| 4 | (Adults OR Adult) OR (adult[MeSH Terms]) | 7,941,617 |
| 5 | (Pregnancy[MeSH Terms]) OR (pregnant women[MeSH Terms]) | 901,700 |
| 6 | #1 AND #2 AND #3 AND #4 | 162 |
| 7 | #6 NOT #5 | 159 |

| | | |
|---|---|---|
| 8 | Animals[MeSH Terms] | 23,585,166 |
| 9 | Humans[MeSH Terms] | 18,829,206 |
| 10 | #8 NOT #9 | 4,755,960 |
| 11 | #7 NOT #10 | 156 |
| 12 | #11 (Filters: from 1998 – 2020) | 145 |

The first two steps of the search were conducted with the assistance of a research librarian. The final step is a manual search of the reference list of all identified sources of evidence that meet the inclusion criteria to locate additional studies.

Inclusion criteria

JBI recommends an agreement between the title, review questions and inclusion criteria, and further points out the PCC guidelines for topic and review questions. JBI recommends that the participants, concepts, context and types of evidence sources be clearly defined *a priori* and considered when designing the inclusion criteria,[69]. In contrast, Arksey and O'Malley designed their inclusion criteria *post hoc* using "type of study, type of intervention care recipient group and caregiver group" based on their review objective. The JBI recommendation is adopted here because stating the inclusion criteria from the start will give clarity to the process of screening articles.

*Participants*

Studies involving adults living with HIV, non-pregnant, and who are either on HAART or treatment naive will be considered.

*Concept*

This review is designed to identify the risk of cardiovascular disease among adults living with HIV using dietary quality estimates. Dietary quality has been defined above as the degree of adherence to specific dietary guidelines (in this case, guidelines to reduce the risk of cardiovascular disease),[21]. Therefore, all studies that assess diet quality using either diet quality scores or through the intake of a specific nutrient or food component that relate to the risk of cardiovascular disease will be included. All diet quality indices will be included in the search strategy. Since it has been established that food insecurity is related to diet quality,[53], studies that assess food insecurity will also be included.

Food insecurity has been measured using the indices enumerated above. For this review, we will make use of the food insecurity/hunger score or results given by the included sources of evidence.

The risks of cardiovascular diseases that will be considered as the main outcome are hypertension and dyslipidemia. Since the main exposure we are interested in is diet quality,

studies that investigate the risk of cardiovascular disease without assessing diet quality will not be included. However, because we assumed that there is paucity of evidence, studies that assess diet quality without drawing inference on the risk of cardiovascular disease will be included; we will then provide our own interpretation of the dietary quality results and how this may relate to cardiovascular diseases based on literature.

*Context*

Research on dietary recommendation and how they affect health and diseases have expanded over the years. The use of HAART has also changed the narratives of HIV infection. It is therefore ideal to include only recent studies in this review. As stated above, studies published earlier than 1998 will be excluded.

*Types of Sources*

All primary studies and reviews conducted on human subjects will be included. Laboratory studies, research conducted on biochemical substances and studies that are not published in English will be excluded.

**Stage 3: Study selection**

After the search has been conducted, the identified and collated citations will be exported into EndNote X9 (Clarivate, Analytics, PA, USA) to remove duplicates. The new citations will be uploaded to Rayyan QCRI (Copenhagen: The Nordic Cochrane Centre, Cochrane),[74] where titles and abstracts will be assessed independently against the inclusion criteria by two members of the research team. Disagreements on screened citations will be discussed and resolved by consensus or the intervention of a third reviewer when necessary. This approach is consistent with methodology previously developed and used,[61, 69, 75].

Full text reports of studies that passed the initial stage of screening will be retrieved and screened to verify their conformance with the inclusion criteria. Articles that fail to meet the inclusion criteria here will be excluded and reasons will be included in the final report.

A full report of the search will be presented in a Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Review (PRISMA-ScR) flow chart and included in the final report. Details of excluded studies and reasons for their exclusion will be compiled from a predefined list, those suggested and agreed on by the reviewers during the process of review will also be included. This list of exclusion criteria will be classified and included in the final report.

**Stage 4: Charting the data**

Following recommendations, a pre-designed tabulated data extraction tool template will be piloted on ten included studies,[69]. JBI identified that there usually is a need to chart additional

data unforeseen from the time of study design, therefore any modification made to the tool will be detailed in the full report of this review,[69]. This chart helps the reviewers to easily keep track of each source of evidence and gives the reader a quick and logical overview of the results that answer the review questions,[61, 74].

Data extracted will be tabulated as follows: first author/year of publication, country, aim of the study, population/sample size, study design, participant recruitment, duration of study, diet quality index used and/or food insecurity measure used, outcome, risk of the cardiovascular disease reported and prevalence, key findings that relate to the review questions, author's conclusion, interpretation, and recommendations.

**Stage 5: Collating, summarizing and reporting the results**

Quantitative data extracted will be presented in tables or charts (as appropriate) in line with the review questions. An integrated descriptive summary and interpretation of the charts or tables will follow. Qualitative data will be presented thematically, pre-identified themes that may be reported include types of diet quality index, risk of cardiovascular diseases reported, diet quality status by gender, diet quality status by geographical location. Other themes identified while collating data will also be included. Meta-analysis of data or qualitative evaluation of included studies will not be conducted for this review. This review is intended to give a descriptive overview of diet quality, food insecurity status and risk of cardiovascular diseases of adults living with HIV.

**Stage 6: Consultation**

This stage is optional and is not planned to be conducted for this scoping review.

## PATIENT OR PUBLIC INVOLVEMENT

Patients or public involvement is not applicable in the design of this scoping review protocol.

## ETHICS AND DISSEMINATION

The review will not require any generation of primary data; all documents will be retrieved from the public domain. This review, therefore, does not require ethical approval. It forms part of dissertation towards a Master of Medical Science in Nutrition (MMedSci Nutrition) which is underway. Results will be presented at conferences and published in a peer-reviewed journal.

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## CONTRIBUTORS

All authors were involved in the conceptualization of the scoping review protocol. IOO led the process, drafted the protocol and wrote the manuscript under the supervision of JH, SB, and AD. All authors approved the publishing of this protocol.

**COMPETING INTEREST**

None declared

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# DIET QUALITY, FOOD INSECURITY AND RISK OF CARDIOVASCULAR DISEASES AMONG ADULTS LIVING WITH HIV/AIDS: A SCOPING REVIEW PROTOCOL



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# TITLE: DIET QUALITY, FOOD INSECURITY AND RISK OF CARDIOVASCULAR DISEASES AMONG ADULTS LIVING WITH HIV/AIDS: A SCOPING REVIEW PROTOCOL

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## ABSTRACT

**Introduction:** Cardiovascular diseases (CVD) are the single greatest contributor to global mortality. The successful introduction and scale up of antiretroviral therapy delivered a reduction in HIV mortality but was followed by an increased prevalence of comorbidities among People Living with HIV (PLWH). A higher quality diet can delay or prevent the onset of comorbidities related to HIV infection. Diet quality and its measures are not fully established among PLWH. This review aims to identify the diet quality and food insecurity indices that have been used among PLWH and how these constructs are associated with risk of developing CVD.

**Methods and analysis:** The framework recommended by Arksey and O'Malley and the Joanna Briggs Institute's (JBI) manual for review authors will be adopted for this review. The Preferred Reporting Items for Systematic review and Meta-Analyses extension for Scoping Reviews guidelines will also be duly utilized. A search strategy was developed using keywords related to the topic. The search will be conducted on PubMed, EbscoHost, Scopus, Web of Science and COCHRANE library databases. A MEDLINE search was conducted on 11th November 2020. Titles and abstracts of retrieved records will be screened independently by two reviewers. Data will be extracted from records that meet the inclusion criteria using a predesigned charting tool. Discrepancies in decisions made by reviewers will be resolved by consensus or the decision of a third reviewer. Extracted data will be presented in tables or charts in line with the review questions. A descriptive summary of the charts or tables will follow.

**Ethics and dissemination:** Ethical approval is not required for a scoping review. Findings will inform other studies currently underway and will be presented at conferences and published in peer review journals.

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**Keywords:** HIV infections, diet quality, food insecurity, cardiovascular diseases

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- This will be the first scoping review to explore the diet quality and food security status of PLWH with or at risk of CVD
- The non-limiting study selection criteria will enable the scoping review to capture all available sources of evidence.
- The Preferred Reporting Items for Systematic Reviews and Meta-Analysis extension for Scoping Reviews will be used, this will ensure transparent reporting of findings.

- The scoping review will be based on a comprehensive search strategy that was designed in collaboration with a research librarian and includes sources from seven databases and the grey literature.

## INTRODUCTION

Globally, cardiovascular diseases (CVD) are the leading cause of death,[1, 2] with hypertension, diabetes, and dyslipidemia identified as principal risk factors for the development of CVD,[3]. In people living with HIV (PLWH), a three-fold increase in the global burden of HIV-related CVD has been reported over the last two decades. A systematic review concluded that PLWH are twice as likely to develop CVD compared to their HIV negative counterparts,[4]. This finding could be explained by several contributing factors including the infection itself and its treatment.

It is known that the successful introduction and scale-up of effective Highly Active Antiretroviral Therapy (HAART) brought a reduction in the rate of HIV mortality and together with a reducing incidence rate, resulted in an ageing cohort of people living with HIV (PLWH),[5, 6]. This, however was followed by a higher risk of morbidity, and increased prevalence of comorbidities including obesity, dyslipidemia, hypertension, and other cardiovascular diseases among PLWH,[7, 8]. Furthermore, other intermediate CVD risk factors such as lipodystrophy, increased central adiposity, insulin resistance, and diabetes have also directly been linked with the use of HAART,[9, 10]. HIV infection and HAART use have, therefore, been reported to significantly increase the risk for CVD,[11, 12]. Cardiovascular risks are also affected by other lifestyle factors such as dietary intake, smoking and physical activity,[13].

Similar to the general population, lifestyle modification is an essential first step in the management of CVD among PLWH. Dietary interventions have been demonstrated to reduce the risk of CVD in the HIV-uninfected population,[14-18]. There is an absence of HIV-specific dietary recommendations,[19]. As a result, international guidelines have suggested adherence to the American College of Cardiology and American Heart Association (ACC/AHA) dietary guidelines for the management of CVD among PLWH,[18].

### Diet Quality

Diet quality is a concept that is not clearly defined; no consensus has been reached to have a specific meaning that can be applied in all contexts,[20]. Diet quality indices are generally developed to reflect how much an individual or population's food consumption conforms to

dietary guidelines and recommendations within a context,[20]. Diet quality is being increasingly adopted in nutritional epidemiology surveys to assess dietary patterns and evaluate the effectiveness of a specific dietary intervention. Since a relationship has been established and understood between food and human physiological function, diet quality has also been used as a proxy to predict mortality and risk of chronic diseases,[21, 22].

Diet quality has been measured in diverse ways. Some studies have assessed and compared the intake of a specific nutrient or food components with recommended dietary standards or guidelines,[23, 24]. Nutrition professionals, however, agreed that overall dietary pattern or the consumption of food groups is a better indication of diet quality rather than a single nutrient intake,[25]. Diet quality indices were, therefore, designed as a tool to connect food and nutrient intake to the incidence of chronic diseases, mortality, and morbidity,[25]. Most epidemiological studies have, since then, measured diet quality using scientifically robust indices enabling standardized assessment,[20, 26, 27].

Diet quality Indices

Several diet quality indices have been developed and used over the years. Some were used to evaluate adherence to dietary guidelines while others monitor changes in dietary patterns over time,[27]. Diet quality indices have also been used to identify unfavourable patterns of intake,[28]. Components assessed in diet quality indices include intake of specific macro or micronutrients, adherence to recommended serving sizes of food groups, or inclusion of predefined healthy food items,[20, 28]. In summary, diet quality has been used to measure both inclusion of specific foods and nutrients, and variety of diet.

Examples of diet quality indices include:

- Healthy Eating Index (HEI) which was designed based on the Dietary Guidelines for Americans and other dietary patterns set by the United States Department of Agriculture (USDA),[29-31].
- Mediterranean Diet Score (MDS) assessing degree of adherence to Mediterranean dietary guidelines among adults including the elderly,[32].
- Diet Quality Index (DQI) designed to reflect risk of common diet-related diseases,[33], further updated and renamed as Diet Quality Index-International (DQI-I),[34].
- Recommended Food Score (RFS) which contains 23 food items and measures overall food quality,[35].
- Dietary Diversity Score (DDS),[36] and Food Variety Score (FVS),[37] which are the total count of food groups and food items consumed respectively by a unit of population

(household or individual) over a specified period of time. This does not put into account the quantity of food or food groups.

- Dietary Approaches to Stop Hypertension (DASH) diet score which is based on eight food and nutrient components and high in fruits and vegetables,[38].
- Dietary Inflammatory Index (DII) which predicts level of inflammatory markers and their outcome on health,[39].

Due to the complex and dynamic nature of diet quality, several reviews investigating associations between diet quality indices and disease risks have been conducted in the general population,[26-28, 40-42]. Poor diet quality increases the risk of mortality and morbidity in the HIV-uninfected population,[43], Some studies have also evaluated diet quality among PLWH,[7, 44-50]. Researchers from Boston in the United States conducted a cross-sectional study using the HEI tool, and reported that diet quality was lower among PLWH and significantly lower among women living with HIV when compared to HIV-negative controls,[7]. This study did not link results with risk of CVD.

**Food insecurity**

Food insecurity is defined as limited availability of and access to sufficient, safe, and nutritious food to support healthy living,[51, 52]. The Food and Agriculture Organization (FAO), in the most recent report on the state of global food security and nutrition, estimated that 690 million people are hungry, equivalent to 8.9 percent of the world population. The FAO projects that the Covid-19 pandemic will exacerbate global food insecurity through disrupting social and economic systems, potentially resulting in up to an additional 132 million people experiencing undernutrition in 2020,[53].

Socioeconomic factors such as food insecurity can influence diet quality. Muhammad et al. [54] reported that 55% of their sample of PLWH in the USA (aged 50 years and older) are food insecure, and that food insecurity was linked to lower diet quality, irrespective of income,[54]. This finding is supported by evidence in the general population,[55], and corroborated by the FAO report,[45]. Given the current food security situation and the link with diet quality studies that assess food insecurity status will be included in our review.

Measures of Food Security

Food security has been assessed by several indicators at national, household, and individual levels. Some indicators measure food consumption adequacy while others gather additional information on experiences and behavioural responses,[56]. There have been several

paradigms in the concept of food security which have influenced the formulation of new indices. Focus has shifted from global and national food security measures alone to include additional household and individual measures,[57].

Food security indicators may include:

- Food Consumption Score (FCS) which is used to assess food security and vulnerability by the World Food Program,[58].
- Household Dietary Diversity Score (HDDS) which is seen as the simplest possible measure at the household level,[59].
- Household Food Security Survey Module (HFSSM) developed by the United States Department of Agriculture (USDA),[60].
- Household Food Insecurity Access Scale,[51] used by the Food and Nutrition Technical Assistance-II (FANTA-II) initiative,[56].
- Food Insecurity Experience Scale (FIES) developed by FAO[61].

The extent to which diet quality has been assessed in the context of HIV is not known. The importance of diet quality in the prevention and management of CVD cannot be overemphasized. This scoping review is necessary to aggregate information on the depth of research on diet quality and HIV.

**Aims**

The aims of this review include:

- To determine the diet quality and food security status of PLWH with or at risk of CVD.
- To identify the range and utility of diet quality and food security indices among PLWH with or at risk of CVD.

## METHODS AND ANALYSIS

The use of scoping reviews to synthesize evidence has increased over the years. As with other forms of literature reviews, they serve general functions of collection, evaluation, and presentation of available research evidence,[62]. Scoping reviews can also be termed “scoping studies” and “mapping reviews”,[63, 64].

There are several reasons why conducting a scoping review is appropriate to answer our research aims. The scoping review could be a step leading to a full systematic review,[65]. In this case, it will identify the feasibility of a systematic review and meta-analysis, the availability of sources of evidence, and previous systematic reviews that have been conducted,[62]. In line with suggestions made by several authors about the value of scoping reviews, this scoping review will inform us about the current state of knowledge and types of

evidence available on our topic of interest,[62], as well as illuminate knowledge gaps,[65, 66]. Furthermore the review will also summarize how research is conducted in the field of interest,[65]; appropriate study populations, research designs, and tools can be identified,[66]. Finally, key concepts and their definitions will be identified,[65]. These concepts can be classified based on how they relate; their similarities and differences can be identified and yield a "concept map",[66]. An example of a recent scoping review explained the concept of formative peer assessment in a healthcare education programme,[67].

Scoping reviews are useful when the field of study is broadly heterogeneous,[67]; diet quality has different indices that are broadly used to appraise various components of dietary intake. Similarly, food security has been measured using a variety of indices. This review will specifically provide a summary of the extent to which diet quality and food security have been explored among PLWH while identifying tools that have been used to evaluate these constructs. Given the emerging concerns of risks of CVD among PLWH, we will identify how much of this concept has been explored within the context of diet quality and food security. This could identify grey areas among these concepts of diet quality, food insecurity, and risks of CVD among PLWH, and potentially inform areas for future research. All the above reasons justify the use of scoping review methodology for this study, [62-66, 68].

The methodology proposed by Arksey and O'Malley,[62] will form the bedrock for this scoping review. Input from the Levac, Colquhoun [69], Peters, Godfrey [70] will also be incorporated. The JBI manual recommends that a protocol stating a stepwise approach to the scoping review be designed and that a set of criteria for including or excluding studies should be determined *a priori.* These criteria must reflect the aim as well as the questions of the review,[71].

The framework proposed by Arksey and O'Malley consists of six stages of which five are mandatory. The stages are:

1. Identifying a research question;
2. Identifying relevant studies;
3. Study selection;
4. Charting the data;
5. Collating, summarizing and reporting the results;
6. Consultation exercise (optional).

Stage six will be omitted as this scoping review is not intended to provide evidence to inform clinical decisions. It will however provide an overview of the literature on dietary components related to risks of CVD in PLWH and give an indication whether the type of data is appropriate

for meta-analyses. Given the increased risk of CVD in PLWH, this review will also inform how best to assess dietary intake in this cohort.

**Stage 1: Identifying the review question**

Common to all review methodologies, scoping reviews start with the formulation of a well-defined research topic that helps to clarify the search strategy,[72]. Guidelines recommend a broad approach to develop a scoping review question, enabling generation of the required depth,[62]. A review question should identify the population, concept, and context (PCC) of the study, as recommended by the JBI,[70].

This review will be carried out to map the breadth of research on diet quality, food security, and risk of CVD among PLWH. The primary review question is:

- What is the current diet quality and food insecurity status of PLWH with or at risk of CVD?

The introduction of highly active antiretroviral therapy (HAART) in the late 1990s,[73] brought a significant change to the health outcomes of PLWH,[74]. The word "current" has been included as studies published since 1998 will be considered for the purpose of this scoping review. This time-period has been selected based on the recorded time for the global scale-up of HAART.

In addition to the main question this scoping review also seeks to answer the following secondary questions:

- What methodologies have been used to assess the dietary quality and food security of PLWH with or at risk of CVD?

**Stage 2: Identifying relevant studies**

It is recommended that a scoping review should exhaustively include all sources of evidence, published, or unpublished that can provide insights into the research question,[62]. A three-stage systematic approach will be adopted for this scoping review. This ensures all published and unpublished sources of evidence are captured,[70]. The first stage is a preliminary search of at least two databases to identify and analyze keywords, text words, index terms and Medical Subject Headings (MeSH) terms related to the search. This was completed on MEDLINE (PubMed) and CINAHL (EBSCOhost) as recommended,[70]. During this stage, key search components and other words that relate to them were identified. The MeSH terms obtained from databases will enable linking other terms related to our search components which have not been identified. Abbreviations of key search terms such as "PLWH" and "PLWHIV" were identified during the preliminary search of articles. Search terms and abbreviations related to various diet quality indices were also identified from published articles.

In the second stage, a full and comprehensive search strategy was developed from the information retrieved and modified to suit each database. The databases that will be searched include, Medline (via PubMed), Africa wide, CINAHL, APA Psyc info (via EBSCOhost), Scopus, Web of Science, COCHRANE library, and databases for grey literature such as ProQuest and AHRQ Agency for Healthcare Research and Quality. These databases are commonly known for biomedical research. Table 1 contains an example of a preliminary full search strategy for PubMed.

Table 1: Full search strategy for MEDLINE conducted on 11/11/2020

| # | Searches | Records retrieved |
|---|---|---|
| 1 | (((HIV positive OR Human Immuno Deficiency Virus OR People Living with HIV OR PLWH OR PLWHA OR PLWHIV OR PLHIV OR AIDS OR HAART OR Highly Active Antiretroviral OR ART OR Antiretrovirals OR Antiretroviral Therapy) OR (HIV infections[MeSH Terms])) OR (HIV[MeSH Terms])) OR (antiretroviral therapy, highly active[MeSH Terms]) | 595,201 |
| 2 | (Diet quality OR Mediterranean Diet Score OR MDS OR Healthy Eating Index score OR HEI OR DASH diet score OR Diet Quality Index score OR DQI OR Diet Diversity Score OR Dietary Diversity OR DDS OR Food Insecurity) OR (Diet[MeSH Terms]) | 365,364 |
| 3 | ((((Blood pressure OR High blood pressure OR Lipid Profile OR Hyperlipidemia OR Dyslipidemia OR Hypercholesterolemia OR Hyperglyceridemia OR Low HDL Cholesterol OR Low High-Density Lipoprotein OR Elevated LDL Cholesterol OR Elevated Low-Density Lipoprotein OR Cardiovascular disease OR Hypertension) OR (Blood Pressure[MeSH Terms])) OR (Hypertension[MeSH Terms])) OR (Dyslipidemia[MeSH Terms])) OR (Cardiovascular disease[MeSH Terms]) | 3,208,278 |
| 4 | (Adults OR Adult) OR (adult[MeSH Terms]) | 7,941,617 |
| 5 | (Pregnancy[MeSH Terms]) OR (pregnant women[MeSH Terms]) | 901,700 |
| 6 | #1 AND #2 AND #3 AND #4 | 162 |
| 7 | #6 NOT #5 | 159 |
| 8 | Animals[MeSH Terms] | 23,585,166 |
| 9 | Humans[MeSH Terms] | 18,829,206 |
| 10 | #8 NOT #9 | 4,755,960 |
| 11 | #7 NOT #10 | 156 |
| 12 | #11 (Filters: from 1998 – 2020) | 145 |

The first two steps of the search were conducted with the assistance of a research librarian. The final step is a manual search of the reference list of all identified sources of evidence that meet the inclusion criteria to locate additional studies.

Inclusion criteria

JBI recommends an agreement between the title, review questions and inclusion criteria, and further points out the PCC guidelines for topic and review questions. JBI recommends that the participants, concepts, context and types of evidence sources be clearly defined *a priori* and considered when designing the inclusion criteria,[70]. In contrast, Arksey and O'Malley designed their inclusion criteria *post hoc* using "type of study, type of intervention care recipient group and caregiver group" based on their review objective. The JBI recommendation is adopted here because stating the inclusion criteria from the start will give clarity to the process of screening articles.

*Participants*

Studies involving adults living with HIV, non-pregnant, and who are either on HAART or treatment naive will be considered.

*Concept*

This review is designed to identify the risk of CVD among adults living with HIV using dietary quality estimates. Dietary quality has been defined above as the degree of adherence to specific dietary guidelines (in this case, guidelines to reduce the risk of CVD),[20]. Therefore, all studies that assess diet quality using either diet quality scores or through the intake of a specific nutrient or food component that relate to the risk of CVD will be included. All diet quality indices will be included in the search strategy. Since it has been established that food insecurity is related to diet quality,[54], studies that assess food insecurity will also be included.

Food insecurity has been measured using the indices enumerated above. For this review, we will make use of the food insecurity/hunger score or results given by the included sources of evidence.

The risks of CVD that will be considered as the main outcome are hypertension and dyslipidemia. Since the main exposure we are interested in is diet quality, studies that investigate the risk of CVD without assessing diet quality will not be included.

*Context*

Research on dietary recommendation and how they affect health and diseases have expanded over the years. The use of HAART has also changed the narratives of HIV infection. It is therefore ideal to include only recent studies in this review. As stated above, studies published earlier than 1998 will be excluded.

*Types of Sources*

All primary studies and reviews conducted on human subjects will be included. Laboratory studies, research conducted on biochemical substances and studies that are not published in English will be excluded.

**Stage 3: Study selection**

After the search has been conducted, the identified and collated citations will be exported into EndNote X9 (Clarivate, Analytics, PA, USA) to remove duplicates. The new citations will be uploaded to Rayyan QCRI (Copenhagen: The Nordic Cochrane Centre, Cochrane),[75] where titles and abstracts will be assessed independently against the inclusion criteria by two members of the research team. Disagreements on screened citations will be discussed and resolved by consensus or the intervention of a third reviewer when necessary. This approach is consistent with methodology previously developed and used,[62, 70, 76].

Full text reports of studies that passed the initial stage of screening will be retrieved and screened to verify their conformance with the inclusion criteria. Articles that fail to meet the inclusion criteria here will be excluded and reasons will be included in the final report.

A full report of the search will be presented in a Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Review (PRISMA-ScR) flow chart and included in the final report. Details of excluded studies and reasons for their exclusion will be compiled from a predefined list, those suggested and agreed on by the reviewers during the process of review will also be included. This list of exclusion criteria will be classified and included in the final report.

**Stage 4: Charting the data**

Following recommendations, a pre-designed tabulated data extraction tool template will be piloted on ten included studies,[70]. JBI identified that there usually is a need to chart additional data unforeseen from the time of study design, therefore any modification made to the tool will be detailed in the full report of this review,[70]. This chart helps the reviewers to easily keep track of each source of evidence and gives the reader a quick and logical overview of the results that answer the review questions,[62, 75].

Data extracted will be tabulated as follows: first author/year of publication, country, aim of the study, population/sample size, study design, participant recruitment, duration of study, diet quality index used and/or food insecurity measure used, outcome, risk of the CVD reported and prevalence, key findings that relate to the review questions, author's conclusion, interpretation, and recommendations.

**Stage 5: Collating, summarizing and reporting the results**

Quantitative data extracted will be presented in tables or charts (as appropriate) in line with the review questions. An integrated descriptive summary and interpretation of the charts or tables will follow. Qualitative data will be presented thematically, pre-identified themes that may be reported include types of diet quality index, risk of CVD reported, diet quality status by gender, diet quality status by geographical location. Other themes identified while collating data will also be included. Meta-analysis of data or qualitative evaluation of included studies will not be conducted for this review. This review is intended to give a descriptive overview of diet quality, food insecurity status and risk of CVD of adults living with HIV.

**Stage 6: Consultation**

This stage is optional and is not planned to be conducted for this scoping review.

**Patient and Public Involvement**

No patient involved

## ETHICS AND DISSEMINATION

The review will not require any generation of primary data; all documents will be retrieved from the public domain. This review, therefore, does not require ethical approval. It forms part of dissertation towards a Master of Medical Science in Nutrition (MMedSci Nutrition) which is underway. Results will be presented at conferences and published in a peer-reviewed journal. This protocol is registered on Open Science Framework (OSF) with registration number: https://osf.io/7k3ja

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## CONTRIBUTORS

All authors were involved in the conceptualization of the scoping review protocol. IOO led the process, drafted the protocol and wrote the manuscript under the supervision of JH, SB, and AD. All authors approved the publishing of this protocol.

## COMPETING INTEREST

None declared

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**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 |
|---|---|---|
| **ADMINISTRATIVE INFORMATION** | | |
| Title: | | |
| Identification | 1a | Scoping review – P01L07 |
| Update | 1b | Not applicable (NA) |
| Registration | 2 | Our review was registered with the OSF Registries on 2020-07-03 and last updated on 2020-07-15 at https://osf.io/7k3ja . P03L26 |
| Authors: | | |
| Contact | 3a | Page 01 |
| Contributions | 3b | P12L32 |
| Amendments | 4 | NA |
| Support: | | |
| Sources | 5a | P13L05 |
| Sponsor | 5b | P13L05 |
| Role of sponsor or funder | 5c | P13L05 |
| **INTRODUCTION** | | |
| Rationale | 6 | P06L25 |
| Objectives | 7 | PCC is applicable to a scoping review. P10L24 |
| **METHODS** | | |
| Eligibility criteria | 8 | PCC is applicable to a scoping review. P10L24 |
| Information sources | 9 | P09L15 |
| Search strategy | 10 | P09L22 |
| Study records: | | |
| Data management | 11a | P11L17 |
| Selection process | 11b | P11L17 |
| Data collection process | 11c | P11L34 |
| Data items | 12 | P12L06 |
| Outcomes and prioritization | 13 | P11L03 |

| | | |
|---|---|---|
| Risk of bias in individual studies | 14 | NA |
| Data synthesis | 15a | NA |
| | 15b | NA |
| | 15c | NA |
| | 15d | NA |
| Meta-bias(es) | 16 | NA |
| Confidence in cumulative evidence | 17 | NA |

*** 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.*

BMJ Open

# DIET QUALITY, FOOD INSECURITY AND RISK OF CARDIOVASCULAR DISEASES AMONG ADULTS LIVING WITH HIV/AIDS: A SCOPING REVIEW PROTOCOL



| | |
|---|---|
| Journal: | *BMJ Open* |
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| Complete List of Authors: | Oyetunji, Iyanuoluwa ; University of Cape Town, Department of Human Biology<br>Duncan, Alastair; King's College London, Department of Nutrition and Dietetics<br>Harbron, Janetta; University of Cape Town, Department of Human Biology<br>Booley, Sharmilah; University of Cape Town, Department of Human Biology |
| Primary Subject Heading: | Nutrition and metabolism |
| Secondary Subject Heading: | HIV/AIDS, Infectious diseases, Public health |
| Keywords: | HIV & AIDS < INFECTIOUS DISEASES, NUTRITION & DIETETICS, Public health < INFECTIOUS DISEASES |
| | |

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# TITLE: DIET QUALITY, FOOD INSECURITY AND RISK OF CARDIOVASCULAR DISEASES AMONG ADULTS LIVING WITH HIV/AIDS: A SCOPING REVIEW PROTOCOL

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**Word count:** 3,544

## ABSTRACT

**Introduction:** Cardiovascular diseases (CVD) are the single greatest contributor to global mortality. The successful introduction and scale-up of antiretroviral therapy (ART) delivered a reduction in HIV mortality. Consequently, an association was found between the scale-up of ART and an increased prevalence of comorbidities among People Living with HIV (PLWH) such as hypertension, and dyslipidemia. A higher quality diet can delay the onset of comorbidities related to HIV infection. Diet quality and its methods of assessment are not fully established among PLWH. This review will identify the diet quality and food insecurity indices that have been used among PLWH and how these constructs are associated with risk of developing CVD.

**Methods and analysis:** The frameworks recommended by Arksey and O'Malley and the Joanna Briggs Institute's (JBI) manual for conducting scoping reviews will be adopted. The Preferred Reporting Items for Systematic review and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines will be used for reporting. A search strategy was developed using keywords related to the topic. A preliminary MEDLINE (via PubMed) search was conducted on 11th November 2020 to develop a comprehensive search strategy. The final search will be conducted on PubMed, EbscoHost, Scopus, Web of Science and COCHRANE library databases. Titles and abstracts of retrieved records will be screened independently by two reviewers. Data will be extracted from records that meet the inclusion criteria using a predesigned charting tool. Discrepancies in decisions made by reviewers will be resolved by consensus or the decision of a third reviewer. Extracted data will be presented in tables or chart. A descriptive summary of the charts or tables will follow.

**Ethics and dissemination:** Ethical approval is not required for a scoping review. Findings will inform other studies currently underway and will be presented at conferences and published in peer-reviewed journals.

**Registration number:** https://osf.io/7k3ja


**Keywords:** HIV infections, diet quality, food insecurity, cardiovascular diseases

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- This will be the first scoping review to explore the diet quality and food security status of PLWH with or at risk of CVD
- The Preferred Reporting Items for Systematic Reviews and Meta-Analysis extension for Scoping Reviews will be used, this will ensure transparent reporting of findings.

- The scoping review will be based on a comprehensive search strategy that was designed in collaboration with a research librarian and includes sources from seven databases and the grey literature.
- A major limitation of our review the inclusion of only studies published in English language.
- Only published articles in peer reviewed journals and databases of grey literature will be included.

## INTRODUCTION

Globally, cardiovascular diseases (CVD) are the leading cause of death,[1, 2] with hypertension, diabetes, and dyslipidemia identified as principal risk factors for the development of CVD [3]. In people living with HIV (PLWH), a three-fold increase in the global burden of HIV-related CVD has been reported over the last two decades. A systematic review concluded that PLWH are twice as likely to develop CVD compared to their HIV-negative counterparts [4]. This finding could be explained by several contributing factors including the infection itself and its treatment.

It is known that the successful introduction and scale-up of effective Highly Active Antiretroviral Therapy (HAART) brought about a reduction in HIV mortality rates, and an ageing cohort of PLWH [5]. This, however, has been followed by a higher risk of morbidity, and increased prevalence of comorbidities including obesity, hyperglycemia dyslipidemia, hypertension, and other cardiovascular diseases among PLWH [6, 7]. Furthermore, certain CVD risk factors such as lipodystrophy, increased central adiposity, insulin resistance, and diabetes have also directly been linked with the use of HAART [8, 9]. HIV infection and HAART use have, therefore, been reported to significantly increase the risk for CVD [10, 11]. Cardiovascular risks are also affected by other lifestyle factors such as dietary intake, smoking and physical activity [12].

Similarly to the general population, lifestyle modification is an essential first step in the management of CVD among PLWH. Dietary interventions have been demonstrated to reduce the risk of CVD among the HIV-uninfected population [13-16] and PLWH [14, 15]. However, there is an absence of HIV-specific dietary recommendations for the reduction of CVD risks among PLWH [17].

### Diet Quality

Diet quality is a concept that is not clearly defined; no consensus has been reached to have a specific meaning that can be applied in all contexts [18]. Diet quality indices are generally

developed to reflect how much an individual or population's food consumption conforms to dietary guidelines and recommendations within a context [18]. Diet quality is being increasingly adopted in nutritional epidemiology surveys to assess dietary patterns and evaluate the effectiveness of a specific dietary intervention. Since a relationship has been established and understood between food and human physiological function, diet quality has also been used as a proxy to predict mortality and risk of chronic diseases [19, 20].

Diet quality has been measured in diverse ways. Some studies have assessed and compared the intake of a specific nutrient or food components with recommended dietary standards or guidelines [21, 22]. However, it has been argued that overall dietary pattern or the consumption of food groups is a better indication of diet quality compared to the intake of a single nutrient[23, 24]. Diet quality indices have been, therefore, designed as a tool to connect food and nutrient intake to the incidence of chronic diseases, mortality, and morbidity [23]. Most epidemiological studies have, since then, measured diet quality using scientifically robust indices enabling standardized assessment [18, 25, 26].

Diet quality Indices

Several diet quality indices have been developed and used over the years. Some have been used to evaluate adherence to dietary guidelines while others monitor changes in dietary patterns over time [26]. Diet quality indices have also been used to identify unfavourable patterns of intake [27]. Components assessed in diet quality indices include intake of specific macro or micronutrients, adherence to recommended serving sizes of food groups, or inclusion of predefined healthy food items [18, 27]. In summary, diet quality has been used to measure both inclusion of specific foods and nutrients, and variety of diet.

Examples of diet quality indices include:

- Healthy Eating Index (HEI) which was designed based on the Dietary Guidelines for Americans and other dietary patterns set by the United States Department of Agriculture (USDA) [28-30].
- Mediterranean Diet Score (MDS) assessing degree of adherence to Mediterranean dietary guidelines among adults including the elderly [31].
- Diet Quality Index (DQI) designed to reflect risk of common diet-related diseases,[24], further updated and renamed as Diet Quality Index-International (DQI-I) [32].
- Recommended Food Score (RFS) which contains 23 food items and measures overall food quality [33].

- Dietary Diversity Score (DDS),[34] and Food Variety Score (FVS),[35] which are the total count of food groups and food items consumed respectively by a unit of population (household or individual) over a specified period of time. This does not put into account the quantity of food or food groups.
- Dietary Approaches to Stop Hypertension (DASH) diet score which is based on eight food and nutrient components and high in fruits and vegetables [36].
- Dietary Inflammatory Index (DII) which predicts level of inflammatory markers and their outcome on health [37].

Due to the complex and dynamic nature of diet quality, several reviews investigating associations between diet quality indices and disease risks have been conducted in the general population [25-27, 38-40]. Poor diet quality increases the risk of mortality and morbidity in the HIV-uninfected population [41], Some studies have also evaluated diet quality among PLWH [6, 42-48]. Researchers from Boston in the United States conducted a cross-sectional study using the HEI tool, and reported that diet quality was lower among PLWH and significantly lower among women living with HIV when compared to HIV-negative controls [6]. This study did not link results with risk of CVD.

**Food insecurity**

Food insecurity is defined as limited availability of and access to sufficient, safe, and nutritious food to support healthy living [49, 50]. The Food and Agriculture Organization (FAO), in the most recent report on the state of global food security and nutrition, estimated that 690 million people are hungry, equivalent to 8.9 percent of the world population. The FAO projects that the Covid-19 pandemic will exacerbate global food insecurity through disrupting social and economic systems, potentially resulting in up to an additional 132 million people experiencing undernutrition in 2020 [51].

Socioeconomic factors such as food insecurity can influence diet quality. Muhammad et al. [52] reported that 55% of their sample of PLWH in the USA (aged 50 years and older) are food insecure, and that food insecurity was linked to lower diet quality, irrespective of income [52]. This finding is supported by evidence in the general population,[53], and corroborated by the FAO report [43]. Given the current food security situation and the link with diet quality, we will include studies that assess food security status in our review.

Measures of Food Security

Food security has been assessed by several indicators at national, household, and individual levels. Some indicators measure food consumption adequacy while others gather additional

information on experiences and behavioural responses [54]. There have been several paradigms in the concept of food security which have influenced the formulation of new indices. Focus has shifted from global and national food security measures alone to include additional household and individual measures [55].

Food security indicators may include:

- Food Consumption Score (FCS) which is used to assess food security and vulnerability by the World Food Program [56].
- Household Dietary Diversity Score (HDDS) which is seen as the simplest possible measure at the household level [57].
- Household Food Security Survey Module (HFSSM) developed by the United States Department of Agriculture (USDA) [58].
- Household Food Insecurity Access Scale,[49] used by the Food and Nutrition Technical Assistance-II (FANTA-II) initiative [54].
- Food Insecurity Experience Scale (FIES) developed by FAO [59].

The extent to which diet quality and food security status have been assessed in the context of HIV is not known. This scoping review is necessary to aggregate information on the depth of research on diet quality and HIV.

**Aims**

The aims of this review include:

- To determine the diet quality and food security status of PLWH with or at risk of CVD.
- To identify the range and utility of diet quality and food security indices among PLWH with or at risk of CVD.

## METHODS AND ANALYSIS

The use of scoping reviews to synthesize evidence has increased over the years. As with other forms of literature reviews, they serve general functions of collection, evaluation, and presentation of available research evidence [60]. Scoping reviews can also be termed “scoping studies” and “mapping reviews” [61, 62].

There are several reasons why conducting a scoping review is appropriate to answer our research aims. The scoping review could be a step leading to a full systematic review [63]. In this case, it will identify the feasibility of a systematic review and meta-analysis, the availability of sources of evidence, and previous systematic reviews that have been conducted [60]. In line with suggestions made by several authors about the value of scoping reviews, this scoping review will inform us about the current state of knowledge and types of evidence

available on our topic of interest,[60], as well as illuminate knowledge gaps [63, 64]. Furthermore the review will also summarize how research is conducted in the field of interest,[63]; appropriate study populations, research designs, and tools can be identified [64]. Finally, key concepts and their definitions will be identified [63]. These concepts can be classified based on how they relate; their similarities and differences can be identified and yield a "concept map" [64]. An example of a recent scoping review explained the concept of formative peer assessment in a healthcare education programme [65].

Scoping reviews are useful when the field of study is broadly heterogeneous,[65]; diet quality has different indices that are broadly used to appraise various components of dietary intake. Similarly, food security has been measured using a variety of indices. This review will specifically provide a summary of the extent to which diet quality and food security have been explored among PLWH while identifying tools that have been used to evaluate these constructs. Given the emerging concerns of risks of CVD among PLWH, we will identify how much of this concept has been explored within the context of diet quality and food security. This could identify grey areas among these concepts of diet quality, food insecurity, and risks of CVD among PLWH, and potentially inform areas for future research. All the above reasons justify the use of scoping review methodology for this study [60-64, 66].

The methodology proposed by Arksey and O'Malley,[60] will form the bedrock for this scoping review. Input from Levac, Colquhoun [67], Peters, Godfrey [68] will also be incorporated. The Joanna Briggs Institute (JBI) manual recommends that a protocol stating a stepwise approach to the scoping review be designed and that a set of criteria for including or excluding studies should be determined *a priori.* These criteria must reflect the aim as well as the questions of the review [69].

The framework proposed by Arksey and O'Malley consists of six stages of which five are mandatory. The stages are:

1. Identifying a research question;
2. Identifying relevant studies;
3. Study selection;
4. Charting the data;
5. Collating, summarizing and reporting the results;
6. Consultation exercise (optional).

Stage six will be omitted as this scoping review is not intended to provide evidence to inform clinical decisions. It will however provide an overview of the literature on dietary components related to risks of CVD in PLWH and give an indication whether the type of data is appropriate

for meta-analyses. Given the increased risk of CVD in PLWH, this review will also inform how best to assess dietary intake in this cohort.

**Stage 1: Identifying the review question**

Common to all review methodologies, scoping reviews start with the formulation of a well-defined research topic that helps to clarify the search strategy [70]. Guidelines recommend a broad approach to develop a scoping review question, enabling generation of the required depth [60]. A review question should identify the population, concept, and context (PCC) of the study, as recommended by the JBI [68].

This review will be carried out to map the breadth of research on diet quality, food security, and risk of CVD among PLWH. The primary review question is:

- What is the current diet quality and food insecurity status of PLWH with or at risk of CVD?

The introduction of highly active antiretroviral therapy (HAART) in the late 1990s,[71] brought a significant change to the health outcomes of PLWH [72]. The word "current" has been included as studies published since 1998 will be considered for the purpose of this scoping review. This time-period has been selected based on the recorded time for the global scale-up of HAART.

In addition to the main question this scoping review also seeks to answer the following secondary questions:

- What methodologies have been used to assess the dietary quality and food security of PLWH with or at risk of CVD?

**Stage 2: Identifying relevant studies**

It is recommended that a scoping review should exhaustively include all sources of evidence, published, or unpublished that can provide insights into the research question [60]. A three-stage systematic approach will be adopted for this scoping review. This ensures all peer-reviewed published sources of evidence as well as grey literature are captured [68]. The first stage is a preliminary search of at least two databases to identify and analyze keywords, text words, index terms and Medical Subject Headings (MeSH) terms related to the search. This was completed on MEDLINE (PubMed) and CINAHL (EBSCOhost) as recommended [68]. During this stage, key search components and other words that relate to them were identified. The MeSH terms obtained from databases will enable linking other terms related to our search components which have not been identified. Abbreviations of key search terms such as "PLWH" and "PLWHIV" were identified during the preliminary search of articles. Search

terms and abbreviations related to various diet quality indices were also identified from published articles.

In the second stage, a full and comprehensive search strategy was developed from the information retrieved and modified to suit each database. The databases that will be searched include, PubMed, Africa wide, CINAHL, APA Psyc info (via EBSCOhost), Scopus, Web of Science, COCHRANE library, and databases for grey literature such as ProQuest and AHRQ Agency for Healthcare Research and Quality. Table 1 contains an example of a preliminary full search strategy for MEDLINE.

Table 1: Full search strategy for MEDLINE conducted on 11/11/2020

| # | Searches | Records retrieved |
|---|---|---|
| 1 | (((HIV positive OR Human Immuno Deficiency Virus OR People Living with HIV OR PLWH OR PLWHA OR PLWHIV OR PLHIV OR AIDS OR HAART OR Highly Active Antiretroviral OR ART OR Antiretrovirals OR Antiretroviral Therapy) OR (HIV infections[MeSH Terms])) OR (HIV[MeSH Terms])) OR (antiretroviral therapy, highly active[MeSH Terms]) | 595,201 |
| 2 | (Diet quality OR Mediterranean Diet Score OR MDS OR Healthy Eating Index score OR HEI OR DASH diet score OR Diet Quality Index score OR DQI OR Diet Diversity Score OR Dietary Diversity OR DDS OR Food Insecurity) OR (Diet[MeSH Terms]) | 365,364 |
| 3 | ((((Blood pressure OR High blood pressure OR Lipid Profile OR Hyperlipidemia OR Dyslipidemia OR Hypercholesterolemia OR Hyperglyceridemia OR Low HDL Cholesterol OR Low High-Density Lipoprotein OR Elevated LDL Cholesterol OR Elevated Low-Density Lipoprotein OR Cardiovascular disease OR Hypertension) OR (Blood Pressure[MeSH Terms])) OR (Hypertension[MeSH Terms])) OR (Dyslipidemia[MeSH Terms])) OR (Cardiovascular disease[MeSH Terms]) | 3,208,278 |
| 4 | (Adults OR Adult) OR (adult[MeSH Terms]) | 7,941,617 |
| 5 | (Pregnancy[MeSH Terms]) OR (pregnant women[MeSH Terms]) | 901,700 |
| 6 | #1 AND #2 AND #3 AND #4 | 162 |
| 7 | #6 NOT #5 | 159 |
| 8 | Animals[MeSH Terms] | 23,585,166 |
| 9 | Humans[MeSH Terms] | 18,829,206 |
| 10 | #8 NOT #9 | 4,755,960 |
| 11 | #7 NOT #10 | 156 |

| | | |
|---|---|---|
| 12 | #11 (Filters: from 1998 – 2020) | 145 |

The first two steps of the search were conducted with the assistance of a research librarian. The final step is a manual search of the reference list of all identified sources of evidence that meet the inclusion criteria to locate additional studies.

Inclusion criteria

JBI recommends an agreement between the title, review questions and inclusion criteria, and further points out the PCC guidelines for topic and review questions. JBI recommends that the participants, concepts, context and types of evidence sources be clearly defined *a priori* and considered when designing the inclusion criteria [68]. In contrast, Arksey and O'Malley designed their inclusion criteria *post hoc* using "type of study, type of intervention care recipient group and caregiver group" based on their review objective. The JBI recommendation is adopted here because stating the inclusion criteria from the start will give clarity to the process of screening articles.

*Participants*

Studies involving adults living with HIV, non-pregnant, and who are either on HAART or treatment naive will be considered.

*Concept*

This review is designed to identify the risk of CVD among adults living with HIV using dietary quality estimates. Dietary quality has been defined above as the degree of adherence to specific dietary guidelines (in this case, guidelines to reduce the risk of CVD) [18]. Therefore, all studies that assess diet quality using either diet quality scores or through the intake of a specific nutrient or food component that relate to the risk of CVD will be included. All diet quality indices will be included in the search strategy. Since it has been established that food insecurity is related to diet quality,[52], studies that assess food insecurity will also be included.

Food insecurity has been measured using the indices enumerated above. For this review, we will make use of the food insecurity/hunger score or results given by the included sources of evidence.

The risks of CVD that will be considered as the main outcome are hypertension and dyslipidemia. Since the main exposure we are interested in is diet quality, studies that investigate the risk of CVD without assessing diet quality will not be included.

*Context*

Research on dietary recommendations and how they affect health and diseases have expanded over the years. The use of HAART has also changed the narratives of HIV infection. It is

therefore ideal to include only recent studies in this review. As stated above, studies published earlier than 1998 will be excluded.

*Types of Sources*

All primary studies and reviews conducted on human subjects will be included. Laboratory studies, research conducted on biochemical substances and studies that are not published in English will be excluded.

**Stage 3: Study selection**

After the search has been conducted, the identified and collated citations will be exported into EndNote X9 (Clarivate, Analytics, PA, USA) to remove duplicates. The new citations will be uploaded to Rayyan QCRI (Copenhagen: The Nordic Cochrane Centre, Cochrane),[73] where titles and abstracts will be assessed independently against the inclusion criteria by two members of the research team. Disagreements on screened citations will be discussed and resolved by consensus or the intervention of a third reviewer when necessary. This approach is consistent with methodology previously developed and used [60, 68, 74].

Full text reports of studies that passed the initial stage of screening will be retrieved and screened to verify their conformance with the inclusion criteria. Articles that fail to meet the inclusion criteria here will be excluded and reasons will be included in the final report.

A full report of the search will be presented in a Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Review (PRISMA-ScR) flow chart and included in the final report. Details of excluded studies and reasons for their exclusion will be compiled from a predefined list, those suggested and agreed on by the reviewers during the process of review will also be included. This list of exclusion criteria will be classified and included in the final report.

**Stage 4: Charting the data**

Following recommendations, a pre-designed tabulated data extraction tool template will be piloted on ten included studies [68]. JBI identified that there usually is a need to chart additional data unforeseen from the time of study design, therefore any modification made to the tool will be detailed in the full report of this review [68]. This chart helps the reviewers to easily keep track of each source of evidence and gives the reader a quick and logical overview of the results that answer the review questions [60, 73].

Data extracted will be tabulated as follows: first author/year of publication, country, aim of the study, population/sample size, study design, participant recruitment, duration of study, diet quality index used and/or food insecurity measure used, outcome, risk of the CVD reported

and prevalence, key findings that relate to the review questions, author's conclusion, interpretation, and recommendations.

**Stage 5: Collating, summarizing and reporting the results**

Quantitative data extracted will be presented in tables or charts (as appropriate) in line with the review questions. An integrated descriptive summary and interpretation of the charts or tables will follow. Qualitative data will be presented thematically, pre-identified themes that may be reported include types of diet quality index, risk of CVD reported, diet quality status by gender, diet quality status by geographical location. Other themes identified while collating data will also be included. Meta-analysis of data or qualitative evaluation of included studies will not be conducted for this review. This review is intended to give a descriptive overview of diet quality, food insecurity status and risk of CVD of adults living with HIV.

**Stage 6: Consultation**

This stage is optional and is not planned to be conducted for this scoping review.

## Patient and Public Involvement

No patient involved

## ETHICS AND DISSEMINATION

The review will not require any generation of primary data; all documents will be retrieved from the public domain. This review, therefore, does not require ethical approval. It forms part of dissertation towards a Master of Medical Science in Nutrition (MMedSci Nutrition) which is underway. Results will be presented at conferences and published in a peer-reviewed journal. This protocol is registered on Open Science Framework (OSF) with registration number: https://osf.io/7k3ja

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## CONTRIBUTORS

All authors were involved in the conceptualization of the scoping review protocol. IOO led the process, drafted the protocol and wrote the manuscript under the supervision of JH, SB, and AD. All authors approved the publishing of this protocol.

## COMPETING INTEREST

None declared

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**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 |
|---|---|---|
| **ADMINISTRATIVE INFORMATION** | | |
| Title: | | |
| Identification | 1a | Scoping review – P01L02 |
| Update | 1b | Not applicable (NA) |
| Registration | 2 | Our review was registered with the OSF Registries on 2020-07-03 and last updated on 2020-07-15 at https://osf.io/7k3ja . P03L26 |
| Authors: | | |
| Contact | 3a | Page 01 |
| Contributions | 3b | P12L32 |
| Amendments | 4 | NA |
| Support: | | |
| Sources | 5a | P13L05 |
| Sponsor | 5b | P13L05 |
| Role of sponsor or funder | 5c | P13L05 |
| **INTRODUCTION** | | |
| Rationale | 6 | P06L13 |
| Objectives | 7 | PCC is applicable to a scoping review. P10L08 |
| **METHODS** | | |
| Eligibility criteria | 8 | PCC is applicable to a scoping review. P10L08 |
| Information sources | 9 | P09L04 |
| Search strategy | 10 | P09L09 |
| Study records: | | |
| Data management | 11a | P11L07 |
| Selection process | 11b | P11L07 |
| Data collection process | 11c | P11L24 |
| Data items | 12 | P11L31 |
| Outcomes and prioritization | 13 | P10L28 |

| | | |
|---|---|---|
| Risk of bias in individual studies | 14 | NA |
| Data synthesis | 15a | NA |
| | 15b | NA |
| | 15c | NA |
| | 15d | NA |
| Meta-bias(es) | 16 | NA |
| Confidence in cumulative evidence | 17 | NA |

*** 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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