


BMJ Open Characteristics and impacts of nutritional programmes to address undernutrition of adults living with HIV in sub-Saharan Africa: a systematic review of evidence

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ABSTRACT

Objectives Although some studies have identified various challenges affecting nutritional programmes to effectively tackle undernutrition among people living with HIV, evidence about the characteristics and impacts of these programmes on weight-related nutritional outcomes varies based on country contexts, specific programme goals and the implementation processes. This systematic review sought to synthesise evidence on the characteristics and impact of nutritional programmes on weight-related nutritional outcomes of people living with HIV in sub-Saharan Africa.

Design Systematic review.

Data sources We searched for primary studies published in the following databases: Web of Science, Medline, Scopus, ScienceDirect, ProQuest and Google Scholar, supplemented by checking reference lists of included papers.

Eligibility criteria Studies published from 2005 to 10 July 2020 and reporting on the weight-related nutritional outcomes of undernourished people enrolled in nutritional programmes in HIV care in sub-Saharan Africa were included.

Data extraction and synthesis Data were extracted using a data extraction proforma. Weight-related nutritional outcomes of people living with HIV before and after enrolment in a nutritional programme were compared and narratively synthesised.

Results Sixteen studies assessing the impact of nutritional programmes in HIV care on weight-related nutritional outcomes were included. Of these, 13 examined nutritional programmes implemented in health facilities and the remaining three were delivered outside of health facilities. Nutritional recovery (defined differently in the studies) ranged from 13.1% to 67.9%. Overall programme failure rate, which included default after enrolment in a nutritional programme or non-response, ranged from 37.6% to 48.0%. More specifically, non-response to a nutritional programme ranged from 21.0% to 67.4% and default from the programme ranged from 19.0% to 70.6%. Key sociodemographic, clinical and nutritional characteristics that affect nutritional recovery, non-response and default were also identified.

Strengths and limitations of this study

- This review is the first of its kind to synthesise the evidence with regards to weight-related outcomes of nutritional programmes to address undernutrition for people with HIV across sub-Saharan Africa, which has the largest number of people living with HIV.
- The review assesses multiple weight-related nutritional outcomes and presents a summary of evidence from a range of nutritional programmes.
- However, the diversity and heterogeneity of the studies and nutritional programmes meant that meta-analysis was not possible to be done, a shortcoming of the review.
- This study only focused on papers published in English which may have excluded potential studies on the same topic but published in other languages.

Conclusions and recommendations Nutritional programmes in HIV care have led to some improvements in weight-related nutritional outcomes among people living with HIV. However, the programmes were characterised by a high magnitude of default and non-response. To improve desired weight-related nutritional outcomes of people living with HIV, a holistic approach that addresses longer-term determinants of undernutrition is needed.

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INTRODUCTION

Evidence demonstrates the clinical and social susceptibility of people living with HIV to undernutrition and its wider effects.¹ Inadequate food intake due to lack of appetite, malabsorption and impaired storage and metabolism are clinical causes of undernutrition among people living with HIV,^{2 3} while social factors such as poverty, gender inequality, food insecurity, stigma and discrimination also hinder access to adequate food and nutrition.^{4 5} Undernutrition involves

weight-related stunting (low height for age), wasting (low weight for height), underweight (low weight for age) and micronutrient deficiencies but this particular review will focus on undernutrition.⁶ Weight-related undernutrition (hereafter undernutrition) has various impacts on the well-being of people living with HIV, including on HIV-related mortality in resource poor settings which has been highlighted in a range of studies.^{7–9} Research has also indicated that undernutrition can act as a barrier to the utilisation of HIV care services and antiretroviral therapy (ART) adherence.^{10–12}

The WHO highly recommends the integration of nutritional interventions into HIV care and support services.¹³ To address the impact of undernutrition among people living with HIV, nutritional programmes targeting people living with HIV are operational in resource-poor settings, mainly in sub-Saharan Africa.¹⁴ The key elements of these programmes are nutritional assessment, counselling and nutritional support.^{15–17} The latter component includes the provision of micronutrient, macronutrient or fortified macronutrient supplementation.^{18 19}

Nearly 90% of HIV care sites in sub-Saharan Africa have responded to the WHO recommendations and instituted some forms of nutritional programme,²⁰ with substantial variations between and within countries.^{17 18 21} Donor organisation policies regarding the nutritional programme and availability of national and local resources have led to programme differences observed between countries in sub-Saharan Africa,²² including the type of care^{23 24} and nature of nutritional support provided.^{25–27} Evidence regarding the impact of nutritional programmes on nutritional outcomes is fragmented, mixed and varies by country context, programme goals and implementation. This study aims to systematically review and synthesise evidence on the characteristics and impact of nutritional programmes on nutritional outcomes of undernourished people enrolled in nutritional programmes in HIV care in sub-Saharan Africa.

METHODS

Systematic search strategy

This review was guided by Preferred Reporting Items for Systematic Reviews and Meta-Analyses. Studies published in

English language in the Web of Science, Medline, Scopus, ScienceDirect, ProQuest, from 2005 to 10 July 2020 were searched. Google Scholar and the reference lists of references of selected papers were also searched. The search concepts and terms included “Nutritional programs”, “HIV/AIDS” and “sub-Saharan Africa” (table 1). Outputs of Ovid Medline are shown in online supplemental file 1.

Selection of studies

The screening process involved two stages. The first stage was conducted by FHT and involved screening the studies by title and abstracts against the inclusion criteria. The second stage was conducted by two independent reviewers (FHT and HG) and involved full-text screening of articles. The inclusion criteria were:

- ▶ Longitudinal studies (cohort and interventional) that examined nutritional outcomes of undernourished people (age>15 years) who were enrolled in nutritional programmes in HIV care settings.
- ▶ Studies measuring nutritional outcomes using body mass index, (BMI), weight gain or mid upper arm circumference (MUAC).
- ▶ Studies published since 2005, because most nutritional programmes in sub-Saharan Africa started in 2005 and published in English.

Studies involving children and pregnant women were excluded because different enrolment and nutritional outcome criteria are used to enrol children and pregnant women in programmes. Studies were also excluded from the review if information about age or pregnancy status was not provided (figure 1).

Measurement of exposures

The exposure variables included:

- ▶ Sociodemographic factors: age, sex, residence, marital status and educational status.
- ▶ Clinical factors: WHO clinical stage, CD4 count, functional status, presence of opportunistic infections, and HIV status disclosure.
- ▶ Nutritional factors: baseline nutritional status, the status of food security and other dietary information.

Table 1 Concepts and their respective keywords

Concept 1: Nutritional program	Concept 2: HIV/AIDS	Concept 3: Sub-Saharan Africa
Nutritional program	HIV-1	South of Saharan Africa
Nutritional intervention	HIV-2	Africa
Nutritional care	HIV infection	Western Africa
Food by prescription	Human immunodeficiency syndrome	Central Africa
Supplementary food	Acquired immune deficiency syndrome	
Ready to use Therapeutic food		
Food supplementation	AIDS	List of all countries in sub-Saharan Africa

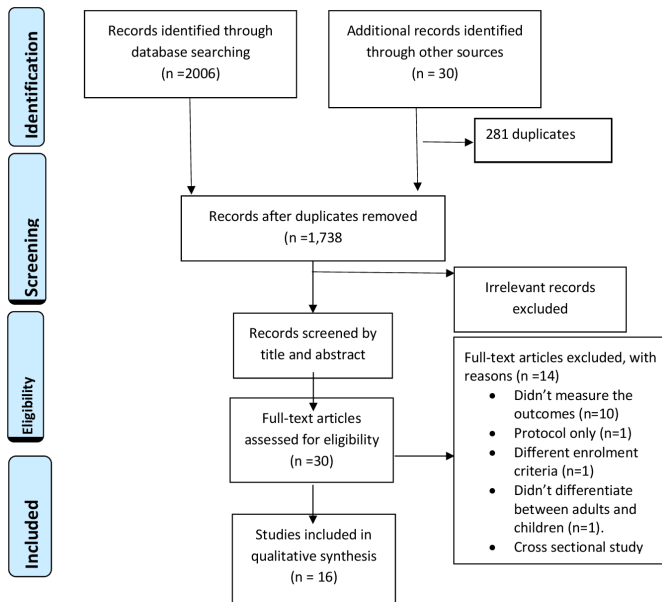


Figure 1 Flow diagram of literature search, selection and reason for exclusion of removed studies.

Measurement of outcomes

The outcome variables were nutritional outcomes of undernourished adults living with HIV, compared before and after enrolment in a nutritional programme. Outcomes included changes in BMI, weight or MUAC and nutritional recovery ($\text{BMI} > 18.5 \text{ kg/m}^2$), default or non-response to the nutritional programme.

Context/setting

Most nutritional programmes in sub-Saharan Africa commenced in 2005. Most nutritional programmes in sub-Saharan Africa included in the reviewed studies had similar programme components which included nutritional assessment, counselling and nutritional support. This review is limited to the sub-Saharan Africa given the duration, enrolment and exit criteria of nutritional programmes are very different in other regions and settings.

Assessment of methodological quality

The Joanna Briggs Institute²⁸ for critical appraisal tool for quasi-experimental studies was used to assess the quality of studies that were included in the review. Two independent reviewers (FHT and HG) conducted the quality assessment.

Data extraction

Data were extracted using a proforma adopted from JBI-MAStARI. The extracted data involved information about the outcome and exposure that affected the nutritional outcomes. In addition, population, sample size, country description of the nutritional programme and the conclusion of the studies were extracted.

Data analysis

Due to the heterogeneity of the studies included in terms of study design, the measure of nutritional outcomes used

and differences in enrolment and exit criteria, a narrative synthesis was the most appropriate analysis procedure for this review. Different variables were identified from the reported findings of each study. Similar patterns were grouped in subsequent coding and analysis performed. Finally, the findings were categorised into two major themes.

Patient and public involvement

No patients or public was involved in this study. This is a systematic review and it is not applicable to make patient and public involvement.

RESULTS

Description of the studies

A total of 2036 papers were obtained from electronic databases and other sources. After removing duplicates 1738 studies were screened by title and abstract and 1708 were deemed irrelevant. The remaining 30 papers were scrutinised further against the inclusion criteria using full-text screening. Sixteen papers involving 25 335 participants were included in the final review (figure 1). Of the 16 final studies included in the review, 9 were retrospective cohort studies, 3 were prospective cohort studies and 4 were randomised trials.

Assessment of methodological quality

The methodological and reporting quality of the reviewed studies was assessed using the JBI critical appraisal tool for quasi-experimental studies (online supplemental file 2). The assessment tool included nine parameters each carrying equivalent weight (online supplemental file 3).

Nine studies, six clinical trials^{25 29–33} and three cohort studies^{24 34 35} scored nine out of nine (100%).

One retrospective cohort study³⁶ scored seven out of nine but two parameters (related to the comparability of study participants and similarity of interventions in both the exposed and non-exposed groups) were not applicable—scoring 100%. Three cohort studies scored six out of nine which is 100% as the same two parameters were not applicable, and the presence of control groups was not clear.^{37–39}

Two retrospective studies scored eight out of nine (89%) as there was no control group.^{40 41} Another retrospective cohort study scored six out of nine, with no control group and two parameters not applicable—a final score of 86%.⁴²

Characteristics of the nutritional programmes

The nutritional programmes examined in this review varied in terms of enrolment criteria, duration and type of nutritional support used. Six studies used $\text{BMI} < 18.5 \text{ kg/m}^2$ as an enrolment criteria.^{24 31 32 38 40 42} Another seven studies used one of the following: bilateral oedema, being bedridden for 50% of the month, TB coinfection, CD4 count < 350 , WHO clinical stage III and IV, in addition to $\text{BMI} < 18.5 \text{ kg/m}^2$ or MUAC < 210

mm).^{25 30 35–37 39 41} Living in a household with HIV positive family members was used as an enrolment criterion in one study.³⁴ Another study enrolled people living with HIV at any stage of the disease and not able to eat.²⁹ A further study used the world food programme (WFP) poverty assessment index, not receipt of other food assistance, CD4 count between 200 and 450 cells per microlitre and ART naïve (new for the treatment) as an enrolment criterion.³³

In five studies, the duration of the nutritional programme ranged from 3 months (for mild and moderate undernutrition) to 6 months (for severe undernutrition).^{24 36 37 40 42} Two studies reported 9 weeks of programme duration^{33, 44}, two had 14 weeks,^{25 32} and a further study³⁰ 24 weeks duration before individual patients exited from the programme. The nutritional programme was 9 months in one study³⁵ and 12 months in three studies.^{31 33 34} No duration limit was reported in two studies.^{38 41}

Various types of nutritional supports were used in nutritional programmes. Ready to use therapeutic food (RUTF) or ready to use supplementary food (RUSF) were used in eight studies.^{24 29–31 36 37 40–42} Corn/soy blended food was used in three studies^{25 32 35 38} and the WFP food basket (which involves generic food rations) was used in two studies.^{33 34} One study used an extract of hypoxis, grapefruit seed extract, sitosterol and sitosterolin, beta-carotene, vitamin E, vitamin, vitamin B1, vitamin B2, vitamin B12, nicotinamide, vitamin C, olive green leaf extract, folic acid and natural antioxidant (biocidin) as the nutritional supplement.³⁹

Although nutritional assessment was an element of nutritional programmes in all studies included in this review, the provision of nutritional counselling was stated only in two studies.^{31 40}

The nutritional programmes were provided in health facilities such as hospitals and clinics in 12 studies,^{24 25 29–32 34–36 40–42} in community-based settings in four studies,^{31 37 38} and no setting was specified in one study.³⁹

Impact of the nutritional programme on weight-related nutritional outcomes (nutritional outcomes hereafter)

In reporting improvements in the nutritional outcome of people living with HIV, studies used various outcome measures. Gain in BMI, weight and MUAC were used either in combination or as separate nutritional outcome measures. BMI was used in nine studies^{24 32 33 35 36 39–42} and both MUAC and BMI were used in two studies.^{30 37} The other two studies used weight gain,^{29 34} and three studies used both BMI and weight gain to measure the nutritional outcomes.^{29 31 34}

Nutritional programme failure, recovery, default and non-response were main outcomes measured in most review studies. The definition of these terms in the studies included are shown in [table 2](#).

Improvement in nutritional status or recovery from the nutritional programme

Eleven studies measured nutritional recovery which was defined differently in various nutritional programmes. Three studies defined programme recovery as BMI>18.5 kg/m² in two consecutive measurements,^{24 40 42} and nutritional recovery in these studies ranged from 32.6%²⁴ to 62.2%.⁴² One study used BMI>18 kg/m² in two subsequent measurements and the absence of oedema, and recovery was 47.4%.³⁶ A further study defined programme recovery as BMI>20 kg/m² and 13.1% attained nutritional recovery against these criteria.³⁸

Four studies used improvements in BMI, without specifying a specific cut-off point.^{32 33 35 41} The improvement in BMI in these studies ranged from 0.6 kg/m² using WFP rations for 12 months³³ to 2.2 kg/m² in a study where participants received a fortified spread for 14 weeks³² and those who used a corn-soy blend showed a BMI increase of 1.7 kg/m².³² Weight gain was used to measure nutritional outcomes in four studies^{29 31 34 37} and weight gain ranged from 0.85 kg³¹ to 3 kg.³⁷

One study using weight gain found that after 9 weeks of supplementation, body weight and fat-free mass increased significantly by 11% (p=0.033), and 11.8% (p=0.033) in

Table 2 The definition of nutritional outcomes in nutritional programmes

Outcomes	Adults
Programme failure	Includes default and non-response from the nutritional programme
Improvement in nutritional status and recovery/graduation from the nutritional programme	Various criteria were used to determine nutritional recovery <ul style="list-style-type: none"> ▶ Reaching BMI of 18.5 kg/m² for two consecutive visits in some studies or BMI>18 kg/m² or BMI>20 kg/m² In other studies, the nutritional outcome was measured in terms of improving weight, BMI or MUAC
Non-response	Participants did not reach the target BMI for two consecutive visits or did not show any change in BMI, weight and MUAC
Default/failure to complete the nutritional programme	Dropped out of the programme before reaching the target BMI, weight or MUAC

BMI, body mass index; MUAC, mid upper arm circumference.

the RUTF group, but not in the control group.²⁹ One study used BMI, weight gain and MUAC,³⁰ and those in the RUSF group had significantly greater gains in weight, BMI and MUAC than those in the no-RUSF group ($p=0.004$ and 0.03 , respectively).

Online supplemental table 1 presents the socioeconomic, demographic, clinical and nutritional determinants of nutritional outcomes among those enrolled in nutritional programme. For sociodemographic factors that affected nutritional outcomes, female gender was associated with nutritional recovery in three studies.^{24 38 42}

Compared with those who did not attend any schooling, individuals who attended school were also more likely to recover than those who did not in one study,⁴² and attending the nutritional programme in a hospital was inversely related to nutritional recovery in another study.²⁴

Few clinical characteristics were associated with nutritional recovery. In one study, not being on ART was associated with nutritional recovery.³⁸ In another study, compared with WHO clinical stage 4, being at WHO clinical stage 1 and 2 were associated with nutritional recovery.⁴² In addition, the absence of opportunistic infection at enrolment to the nutritional programme was associated with nutritional recovery compared with those who had an opportunistic infection.⁴²

Regarding the impact of nutritional characteristics at enrolment, compared with those enrolled with severe undernutrition, those with moderate undernutrition were associated with nutritional recovery in two studies.^{38 42} In one study, enrolment in the nutritional programme with mild undernutrition was associated with nutritional recovery compared with those with severe undernutrition.⁴²

Programme failure rate

The programme failure rate involves a combination of default, non-response and mortality while enrolled in the nutritional programme. The programme failure rate was reported in two studies.^{36 42} The nutritional programme failure rate in a study from Kenya and Uganda was 48%³⁶ and 37.6% in a study from Ethiopia.⁴² Factors that were associated with the programme failure were only assessed in one study³⁶ which found male gender, severe undernutrition at programme enrolment (pre-ART), and ineligibility for ART at enrolment as variables associated with programme failure (online supplemental table 2).

Non-response from the nutritional programme

Three studies from Ethiopia measured non-response to the nutritional programme ranging from 21%⁴⁰ to 29.6%,⁴² and 67.4%.²⁴

Compared with those who attended primary health-care services to receive nutritional services, attending a hospital was associated with greater non-response in one study.²⁴ A study by Tesfay and colleagues examining health facility-based nutritional programmes in Ethiopia reported that being an urban area was associated with non-response.⁴⁰

In terms of clinical characteristics, the same study found advanced WHO clinical stage (stage 4), and bedridden functional status were associated with non-response to the nutritional programme.⁴⁰ Compared with those enrolled with mild undernutrition, severe undernutrition at enrolment was also associated with non-response.⁴⁰

In another study, those with severe food insecurity were less likely to not respond than those who were food secure.²⁴ The third study did not assess factors contributing to non-response (online supplemental table 3).

Default from the nutritional programme

Two studies from Ethiopia reported programme default and associated factors.

In one study, 19% of the study participants did not complete the nutritional programme. Factors that were associated with default were living in urban areas, being employed, attending at a hospital and in clinical stages II and III.⁴⁰ In another study, the default rate was 70.6%.²⁴ Being on ART for less than 6 months and being anaemic were associated with default²⁴ (online supplemental table 4).

In both studies, severe undernutrition at enrolment to the nutritional programme was associated with default from the nutritional programme.^{24 40}

DISCUSSION

Given the susceptibility of people living with HIV to undernutrition, and the synergistic effect of undernutrition in accelerating HIV infection to AIDS, scaling up nutritional programmes in HIV care in combination with other HIV services is vital.⁴³ Despite the provision of nutritional programmes in HIV care settings in many countries,²¹ evidence regarding the effectiveness of these programmes is fragmented—this review sought to address this with regards to sub-Saharan Africa.

Broadly, a range of anthropometric, clinical and socioeconomic parameters were used as enrolment criteria in nutritional programmes in the HIV care setting in sub-Saharan Africa. The duration of the nutritional programmes was characterised by a significant variation between programmes. For instance, nutritional programmes that aimed at the treatment of acute undernutrition were characterised by a shorter duration (ranging from 3 to 6 months) and provision of highly dense nutritional support (RUTF or RUSF).^{24 36 40} However, there were examples where nutritional support was provided for more than 9 months.^{25 30 32} The duration of nutritional programmes that used corn-soy blended ranged from 14 weeks^{25 32} to 9 months,³⁵ and 12 weeks in programmes that used the WFP food rations.³³

There was no optimal duration of the nutritional programme because of the difference in content and nutritional value of the nutritional support used from programme to programme. Nutritional programmes that use dense nutritional supports such as RUTF and RUSF may achieve faster weight gain and perhaps contribute

to a shorter duration in the nutritional programme.^{24 40} These findings are consistent with outcomes from other studies conducted in other parts of the world such as India.⁴⁴

There is strong evidence in the literature regarding the role of nutritional programmes in enhancing weight gain among those enrolled in a nutritional programme with BMI <18.5 kg/m².⁴⁵ However, in nutritional programmes with predetermined programme exit criteria, there was substantial variation in the magnitude of nutritional recovery. Nutritional recovery beyond attaining weight gain can vary from programme to programme depending on the availability of resources. In nutritional programmes that used BMI >18.5 kg/m² in Ethiopia, nutritional recovery was 32.6%,²⁴ 55.3%⁴⁰ and 62.2%.⁴² Other studies did not use a defined cut-off point or used different BMI measure (eg, one used BMI >18 and another used BMI >20) or other measures (weight gain, MUAC) to determine nutritional outcomes. All of these demonstrated that nutritional support of various forms were associated with better nutritional outcomes.

A systematic review that examined the impact of nutritional supplementation on HIV nutritional and clinical prognosis in sub-Saharan Africa found increased weight gain.⁴⁶

Evidence from the current review showed that few studies reported on the rate of overall nutritional programme failure. Two studies from Ethiopia found programme failure rates involving non-response, default, and mortality rates that ranged from 37.6%⁴² to 48.0%.³⁶

Studies examining non-response to the nutritional programme (not reaching a BMI of 18.5 kg/m² in two consecutive visits) were all from Ethiopia. While the nutritional programme was similar in terms of the duration, type of food supplement, funding organisation and policy, there was a big variation in the magnitude of non-response rate between these studies of 21%,⁴⁰ 29.6%⁴² and 67.4%.²⁴ The two studies^{40 42} with a relatively low non-response rate were conducted recently, after several years of implementation of the nutritional programme in Ethiopia, which may suggest that programme non-response rates may have dropped due to the accumulation of experience by the programme.

Two studies from Ethiopia measured default from the nutritional programme and the difference in default between the two studies was substantial—ranging from 19%⁴⁰ to 70.6%.²⁴ While the study by Tesfay *et al*⁴⁰ was conducted recently, the later study by Sadler *et al*²⁴ was conducted at the initial stage of the nutritional programme as a pilot evaluation and may reflect a less developed version of the programme. Reasons for nutritional programme ineffectiveness could include poor taste of the supplement, dietary boredom or HIV-related complications such as mouth thrush as highlighted in a systematic review that involved resource adequate and constrained settings.⁴⁷

It is very difficult to compare nutritional outcomes by country because of the lack of uniformity in the nature

of the nutritional programme in terms of the duration, enrolment criteria and the nutritional support that is given. For instance, nutritional programmes in Ethiopia used ready to use therapeutic or supplementary food for 3 months for mild and moderately undernourished and 6 months for severe undernutrition.^{24 40 42} On the other hand, nutritional programmes from Kenya used ready to use therapeutic or supplementary foods provided in a rural village but no specific duration was given for the nutritional programme.³⁸ Nutritional recovery (achieving BMI greater than 20 kg/m²) in Kenya³⁸ was lesser (13%) than studies from Ethiopia which were 62.2%⁴² and 32.6%.²⁴

The studies provided some insights into factors associated with programme outcomes, including socio-demographic factors. Gender was highlighted, where being male was associated with nutritional programme failure³⁶ and lower rates of recovery^{24 38 42} and living in urban areas was associated with programme non-response.⁴⁰ In one study, attending the nutritional programme in a hospital was associated with lower rates of nutritional recovery.²⁴ Another study found differences between hospitals where attending the nutritional programme at relatively rural hospitals was associated with higher rates of non-response.⁴⁰

Clinical factors were also linked to programme outcomes. For example, not starting ART was associated with nutritional programme failure in one study,³⁶ but another study found it was associated with nutritional programme recovery.³⁸ This might be due to the fact that many individuals in the study by Ahoua *et al*³⁶ were eligible for ART despite the lack of ART initiation because of delayed patient laboratory results or patient refusal. These patients might have died, giving rise to a high magnitude of programme failure in the former study. Being on ART for less than 6 months were associated with default from the nutritional programme.⁴⁰ The absence of opportunistic infection at enrolment was associated with nutritional recovery in one study.³⁶

Severe undernutrition at baseline was associated with a higher nutritional programme failure rate,³⁶ lower likelihood of achieving nutritional recovery³⁸ and default from the nutritional programme.⁴⁰ On the other hand, mild and moderate undernutrition at enrolment was associated with nutritional recovery in one study.⁴² Compared with those who are not enrolled in the nutritional intervention, those enrolled in the nutritional programme were more likely to recover.²⁴ One study found that those with severe food insecurity were less likely to become non-respondents to the nutritional programme.²⁴

Given the clinical, social and economic susceptibility of people living with HIV to undernutrition,⁴⁸ findings from the current review highlighted that nutritional programmes in sub-Saharan Africa have focused on the treatment of undernutrition among people living with HIV.^{24 36 38} For instance, terms such as nutritional recovery, weight gain, default and nutritional recovery were used in all of the studies included to imply the short-term

positive impact of the nutritional programmes among people living with HIV. Measures used in all nutritional programmes were clinical and none provided measures on longer-term nutritional well-being. Longer-term measures such as food security were not included as key programme goals in any of the nutritional programmes despite the wider vulnerability of people living with HIV to food insecurity in sub-Saharan Africa.^{49 50}

Strength and limitations

The key strength of this study is its coverage of sub-Saharan Africa, a major area of HIV infection, and its review of multiple nutrition programmes representing a large population base. It also examines a range of nutrition outcomes. However, the review has some limitations. Some studies had a very small sample size (eg, Oguntibeju *et al*³⁹ (n=35) and Scarcella *et al*⁴¹ (n=106)) which may negatively impact the estimates of the nutritional outcomes and factors associated with them. It was not possible to pool estimates of nutritional outcomes because of the differences in enrolment and exit criteria and programme duration between nutritional programmes. This study only included papers published in English which automatically excluded papers published in other languages, which may lead to reporting bias. The focus of this review is on the impact of nutritional programmes on undernourished people enrolled in nutritional programmes in HIV care settings. However, overnutrition has also been highlighted as an important issue for people living with HIV as it increases the risk of overweight and cardiovascular disease among people with HIV on long-term ART treatment.^{51 52} An examination of programmes designed to address this would be an important area for future reviews.

CONCLUSION AND RECOMMENDATIONS

Despite the use of various enrolment and exit criteria, nutritional programmes in HIV care have led to overall improvements in nutritional outcomes and overall well-being of people living with HIV. However, the programmes reviewed were characterised by problems of effectiveness such as a high magnitude of default and non-response. Various sociodemographic, clinical and nutritional characteristics have an impact on the nutritional outcomes, which gives potential avenues for future research and programme improvement. However, the goal of most nutritional programmes in HIV care settings is to reverse short-term nutritional problems such as undernutrition. In contrast, the impact of nutritional programmes in HIV care should be measured in terms of the programme's capacity to sustainably address the nutritional well-being of individual patients with HIV and others around them over the longer term.⁵³

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Patient consent for publication Not applicable.

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