BMJ Open

Prevalence of malnutrition among old people in Africa: systematic review and meta-analysis

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To cite: Seid AM, Fentahun N. Prevalence of malnutrition among old people in Africa: systematic review and meta-analysis. *BMJ Open* 2022;**12**:e065197. doi:10.1136/bmjopen-2022-065197

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2022-065197).

Received 01 June 2022
Accepted 03 November 2022

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ABSTRACT

Objective To summarise available evidence and estimate the pooled prevalence of malnutrition among old people in Africa.

Design Systematic review and meta-analysis.

Setting Any healthcare or community research reporting the prevalence or incidence of malnutrition in Africa from January 2000 to October 2021.

Participants Old people, aged above 60 years.

Outcome measures Malnutrition, either undernutrition or overnutrition.

Results A total of 1442 studies were retrieved based on the search strategy, where only 36 studies (n=15 266 participants) reported from 11 African countries were included for meta-analysis. The reported prevalence of malnutrition ranges from 2.2% to 77.3% across the continent. Overall, the pooled prevalence rates of undernutrition and overnutrition were 18% (95% CI: 15% to 22%; I^2=98.1; p<0.001) and 33% (95% CI: 22% to 44%; p<0. 001), respectively.

Conclusion The prevalence of malnutrition in old African people is high and differs by setting, assessment tool and country of residence. Hence, due attention to geriatric nutrition is mandatory, and the need for a valid, reliable and simple screening tool should be thought of.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This provides a comprehensive estimate of the prevalence of malnutrition among old people in Africa, including more recent studies conducted in the continent.
⇒ Looked at the prevalence of malnutrition in the elderly using any of the validated screening tools.
⇒ Only HINARI/PubMed and Google Scholars were retrieved.
⇒ Limited to include only English literature.

INTRODUCTION

Background

The global demographic structure of the population is changing dramatically, notably in Africa, due to several social and economic milestones.[1] These resulted in expanding population, improved life expectancy and increased population size of older ages.[1 2] The absolute number of old people (60 years and above[3]) is expected to grow more rapidly in the coming decades in Africa than in any other parts of the world.[1]

The world is also in nutrition transition, a phenomenon where the changes in the foods and beverages consumed along with the reduced physical activity. In Africa, the risk of malnutrition among older people is a major challenge to the healthcare system and needs special and urgent attention. The usual food production practices, marketing style and living standards have all contributed to an increase in the use of low-cost, packaged products that are high in fat, energy and salt, and yet low in nutritional quality. More importantly, poor infrastructure and limited resources, combined with conflict and poor access to healthcare services, are factors that contribute to the overwhelming levels of malnutrition and food insecurity in the continent.[4] The lack of policy direction for old people, combined with prevalent chronic illnesses, adds a significant burden to the growing burden of malnutrition.[5 6] Due to these and other aggravating factors, the government's commitment to ending all forms of malnutrition by 2030[7] will be difficult to achieve.

While any age group may suffer from malnutrition, it is most common among old people due to the changes in physiological, psychosocial and health characteristics of individuals in this age group.[8] Furthermore, malnutrition has serious and life-threatening consequences that are known to be the main causes of increased morbidity and mortality among old people.[9] Besides, complications of malnutrition, such as osteoarthritis, osteoporosis, diabetes, cardiovascular disease and hypertension, inflict a significant social and economic burden on them.[10]

Previous studies reported that the prevalence of malnutrition among old people varies between 1.1% and 72.2% in different settings,[11–15] where some of the variations could be attributed to differences in the

measurement tools, study settings and demographic groups that have been studied.[16 17] Moreover, none of the previous reviews targeted the old people in Africa,[18–21] where the root causes of malnutrition are expected to be large. However, having concrete evidence on the burden of malnutrition using a more rigorous and systematic manner than individual pocket studies is the first step toward enhancing the elderly's interventions and policy direction. Context-specific evidence will better inform decision-makers in making informed decisions on addressing malnutrition among old people for a better quality of life.

Objective

To estimate the prevalence of malnutrition among old people in Africa according to the assessment tools, study setting and regional location.

METHODS

Search strategies

Before the beginning of this systematic review, we conducted a systematic search of review papers from the Cochrane Library, the International Prospective Register of Systematic Reviews and the Joanna Briggs Institute, and no review had been conducted on malnutrition among old people in Africa. Yet, review protocol was not registered. Relevant publications were searched systematically from HINARI, PubMed and Google Scholar sources from 01 January 2000 to 16 October 2021. We employed the search through relevant combinations of Medical Subject Headings terms and related keywords, such as "malnutrition", "obesity", "overweight", "old age people", "older adults", "elderly" and "Africa" as indicated in online supplemental file 1. Lists of references from relevant studies were also manually searched. Countries or territories included in Africa were defined according to the United Nations classification.[22] Studies were imported and checked for duplicates in Mendeley Desktop (V.1.19.3).

Eligibility criteria

Inclusion criteria

Based on the condition, context and population framework,[23] we included research publications in English language from 1 January 2000 to 16 October 2021 that reported the prevalence of malnutrition among old persons aged 60 years and up in African countries. Intending to get a relatively up-to-date prevalence estimate and obtain a comparable age and malnutrition definition, we restricted studies conducted starting in 2000. All studies that reported the prevalence and/or incidence of malnutrition among old people were considered regardless of the study design. When multiple studies reported the prevalence of malnutrition based on the same study, the one with the larger sample size was included.

Exclusion criteria

Qualitative studies, study protocols, abstracts, opinions, commentaries, case reports, review papers and studies on African-Americans who do not live on the African continent were all excluded from the review. Publications reporting malnutrition in post-intervention were excluded. Duplicate articles and articles without access to the full text were removed from the review.

Outcome measuring tools

Studies that measured malnutrition with any standard and validated tools, including questionnaires such as Patient-Generated Subjective Global Assessment, Mini Nutritional Assessment (MNA), Subjective Global Assessment tools or Nutritional Screening Checklist (NCL), anthropometric (mid-upper arm circumference (MUAC), calf-circumference (CC), body mass index (BMI), etc) or biochemical indices (serum haemoglobin, albumin, etc) were considered. We used the reported prevalence of malnutrition or undernutrition based on the standard definition set for each nutritional assessment method. When the entire text of an article could not be obtained or if there was missing information, the corresponding author(s) was contacted through email. If the requested full-text papers were not submitted until 31 October 2021, the study would be discarded.

Study selection and quality assessment

A two-step process was used to select the relevant publications. First, the scan of the titles and abstracts was conducted for the inclusion of references that meet the eligibility criteria. The entire text was retrieved when any doubts existed about the relevance of a study. Second, the full texts were then used to make a judgement on whether or not the study should be included in the review. The two authors work individually on all components of the selection process. Disagreements were settled through conversation.

Selected studies were evaluated using a 10-item rating checklist designed for research reporting prevalence,[24] where better-quality articles have a higher score as indicated in online supplemental table 1.

Data extraction

The two authors separately extracted data from the full-text articles using a predefined standard format produced in Excel. The extract comprised the following information: general (authors, year of publication and country), participants (age, gender and morbidity status) and study details (study design, study setting, sample size, measurement tool used and outcome measures). Morbidity was coded as one or multiple when a single or multiple underlying health conditions were an inclusion criterion.

Statistical analysis

The precoded extracted data in Excel format were exported to STATA software V.14[25] for descriptive and meta-analysis. For each study, the unadjusted prevalence of malnutrition and SEs were calculated, and a logarithmic (log) transformation for proportional data was used to reduce variance and obtain the pooled prevalence as an effect size (ES). Considering the level of methodological

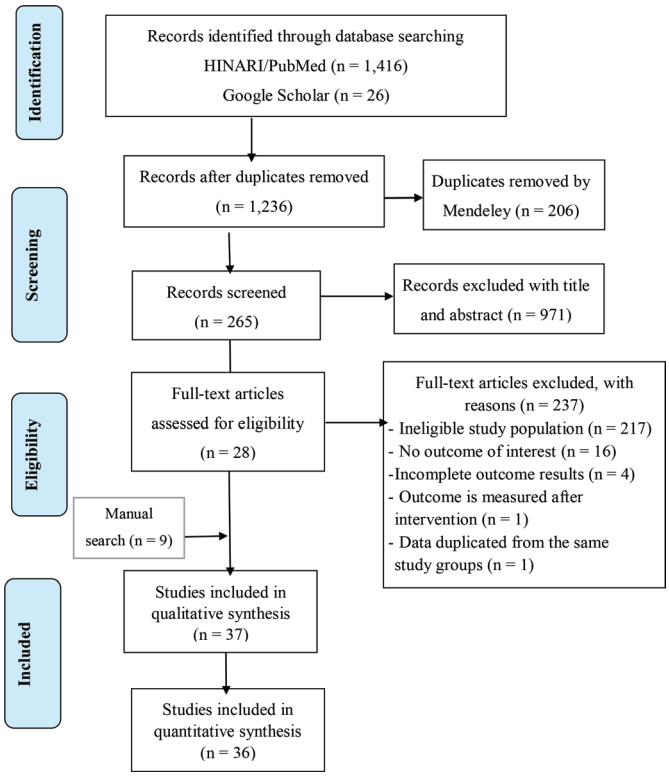

Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow chart of studies screened and reviewed.

heterogeneity and variance within the study, a random-effect model of the DerSimonian and Laird[26] method was used to conduct the meta-analysis.

The heterogeneity between studies was assessed using a forest plot, Cochran's Q test and I^2 test. The I^2 values of 25%, 50% and 75% with a p value less than 0.10 represent low, medium and high heterogeneity, respectively.[27] Publication bias was checked graphically in a funnel plot supplemented by Egger's statistics.[28] We also applied a subgroup analysis, a sensitivity analysis and meta-regression to identify the potential sources of heterogeneity. A statistically significant ES estimate has a p value of less than 0.05.

Patient and public involvement

No patient and public involvement.

RESULTS

Search results

A total of 1442 articles were obtained through searches, of which 206 were removed due to duplicates. With the title and abstract screening, 971 articles were removed depending on the focus of the review (older age in the African continent), relevant nutritional assessment method and language (other than English). Furthermore, 237 articles were retrieved during the full-text screening. Finally, 37 and 36 articles were selected for qualitative (systematic review) and quantitative analyses (meta-analysis), respectively. The comprehensive selection process was presented using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement[29] (figure 1).

Characteristics of included studies

A total of 37 studies reported the prevalence of malnutrition among old people. While 34 studies (92%) were published in the last decades between 2011 and 2020, the remaining 8% were issued between 2001 and 2010. All the included studies were reported from 11 African countries, where more than half (65%, n=24) were from four countries: Ethiopia, Egypt, Nigeria and South Africa.

Seven studies (18.9%) were from Ethiopia[30–36] and six studies (16.2%) each from Egypt[37–42] and Nigeria.[43–48] While five studies (13.5%) were from South Africa,[49–53] four studies (10.8%) were from the Central African Republic and the Republic of Congo,[54–57] three studies (8.1%) from Ghana[58–60] and two studies (6.06%) were from Tanzania.[61 62]

Except for three studies (two cohorts[31 47] and one case–control[44]), all other identified studies were cross-sectional study designs. Malnutrition prevalence was reported in four studies as a comparison between institutional versus non-institutional,[44 61] high versus low economic classes,[50] and with and without dementia.[57] However, one study from Tanzania examined the nutritional status after a post-supplemental food programme[63] and was excluded from the meta-analysis. Majority of the studies (n=22) were conducted in community settings, while 11 studies were conducted among institutionalised elders.

Moreover, a total of 15 266 study participants were found, of whom more than half (58%) were women. The selected studies had sample sizes ranging from 40[64] to 2219[37] people. Regarding the nutritional assessment tools used, more than half of the studies reported malnutrition based on either the full-form or short-form of the MNA tool (MNA-FF: n=15, MNA-SF: n=4); while 18 studies employed various anthropometric dimensions such as BMI, MUAC and CC separately or in combination to assess malnutrition. One study used an interviewer-administered NCL[38] and another study used a combination of MNA and the Geriatric Nutrition Risk Index.[64] Two-thirds (n=23) of the studies reported single (n=8) or multiple (n=15) underlying clinical conditions such as fracture, heart disease, dementia, Parkinson's disease or cancer (online supplemental table 2).

Quality of the studies

According to the quality assessment checklist, studies were either in moderate (6–8 points)[39–42 44 46–48 53 61 64 65] or high-quality groups (9 or 10 points).[30–38 43 45 49–52 54 55 57–60 62 66] Study bias was mostly exacerbated as a result of convenience sampling and a low response rate among study participants. In almost all studies, the possibility of external validity was low as the target population was not nationally representative of the country. However, the quality of two studies[56 63] was not assessed and hence not processed for quantitative data analysis. The first[56] was

due to duplication of results from previous data[57] and the latter[63] was due to the outcome variable being measured after an intervention (online supplemental table 3).

Prevalence of malnutrition

The prevalence of malnutrition varied highly across the studies conducted in different countries, assessment tools used and healthcare settings. We presented an overview of the findings from various studies as undernutrition and overnutrition using two assessment tools in the section below.

Prevalence of undernutrition

Seventeen studies from hospitals (n=5), the communities (n=10), a long-term care centre (n=1) and a daycare centre (n=1) used BMI as a nutritional assessment tool. As low as 0%[53] and 4.0%[49] of research participants, respectively, from the elderly daycare centre and hospital settings in South Africa were classified as undernourished (BMI ≤18.5 kg/m^2). Furthermore, the highest prevalence of undernutrition (25.6%) was reported in a Tanzanian hospital.[62] From the community settings, undernutrition was reported at 9.9% in Ghana[59] and 26.4% in East Africa.[66]

On the other hand, 20 studies from hospitals (n=7), communities (n=11) and long-term care centres (n=2) used MNA as a nutritional assessment tool. The outcome was reported as at risk of overnutrition, undernutrition or normal status. The results showed that old people in the community were more victims of undernutrition compared with hospitals and long-term care centres. The prevalence ranged from 5.7% in Niger[65] to 56% in Egypt[38] and 18% in Egypt[38] to 58.5% in Niger,[65] respectively. On the other hand, in Nigerian hospitals, 2.24%[48] to 40.46%[47] and 11.8%[45] to 52.7%[47] of old people were undernourished or at risk of malnutrition, respectively. Besides, 7.3% in South Africa[50] and 10.8% in Egypt[41] were undernourished using MNA from the long-term care centre. Similarly, 10.9% of community study participants in Egypt[37] and 77.3% in Ethiopia[33] were undernourished, while none from Ethiopia[33] and 41.9% from Egypt[37] were at risk of undernutrition using MNA-SF. Moreover, 4.57% of hospital study participants in Nigeria[46] were undernourished, while 95.43% were either normal or at risk of undernutrition.

Prevalence of overnutrition

Overnutrition was reported in 17 studies that used BMI as a nutritional assessment tool. Accordingly, 77% of the elderly people studied in a South African hospital[49] were overweight or obese. There were none from Tanzania[62] in a comparable situation, while 15.3% of study participants in East Africa[66] and 42.1% in Ghana[59] were affected by overweight or obesity in the community settings.

Meta-analysis

Adequate data were available to conduct pooled malnutrition prevalence estimates for two nutrition screening tools: undernutrition from 36 studies (BMI=16 and MNA=20), and overnutrition from 16 studies using only BMI. Since the MNA-FF/MNA-SF and NCL tools are similar in the interpretation of the outcome variable, they were treated as similar tools. The random pooled prevalence rates of undernutrition and overnutrition in Africa were 18% (95% CI: 15% to 22%; p<0. 001) and 33% (95% CI: 22% to 44%; p<0. 001), respectively (figures 2 and 3).

A high level of statistical heterogeneity was observed between studies (heterogeneity of Cochran Q statistics=1828.98 with df=35 and p<0.001; I^2=98.1%; τ^2=0.01). Moreover, a minimal publication bias has been noted in the published studies. Studies with lower SE and larger sample size might be included, as indicated in the funnel and Egger's publication plots (figure 4). Smaller studies with larger SEs plotted on the right of the funnel plot tend to have both smaller and larger ORs. This may indicate the existence of bias due to small study effects. Moreover, the Egger's plot shows that the data near the origin are unsystematically elevated, where the CI does not include 0, indicating asymmetry in the funnel plot and evidence of publication bias.

Furthermore, Egger's regression asymmetry test value was 3.50 (p=0.008), suggesting publication bias. Here, the positive coefficient indicates that small studies overestimate the ES. However, no study appeared to have a significant impact on the summary ES in the sensitivity analysis, strongly suggesting that the effect estimate is consistent across groups and potentially giving a reliable estimate of the outcome. In addition, the trim-and-fill analysis was performed to examine the potential impact of publication bias on the interpretation of the data. The method adds 12 'missing' studies to the dataset. However, the correction for publication bias does not change the overall interpretation of the findings.

Subgroup analysis and meta-regression

Subgroup analysis and meta-regression were performed for the study regions, settings, assessment tools, age group and presence of multimorbidity using the random-effects inverse variance model with the DerSimonian and Laird estimate. In general, a relatively high prevalence of malnutrition was observed in Central Africa (3.76%; 95% CI: 3.22% to 4.39%) as compared with other regions of the continent. Similarly, the community elderly (3.12%; 95% CI: 2.66% to 3.67%), older age groups (3.54%; 95% CI: 2.32% to 5.41%) and those with no reported clinical condition (3.16%; 95 CI: 2.62% to 3.80%) had a higher malnutrition burden than their counterparts. The prevalence estimates had a statistically significant difference among all subgroups except for the assessment tools used (p=0.430) (table 1).

However, only the study setting was statistically significant (adjusted R^2=39.2%, p=0.049) predicting the prevalence of malnutrition in the meta-regression analysis.

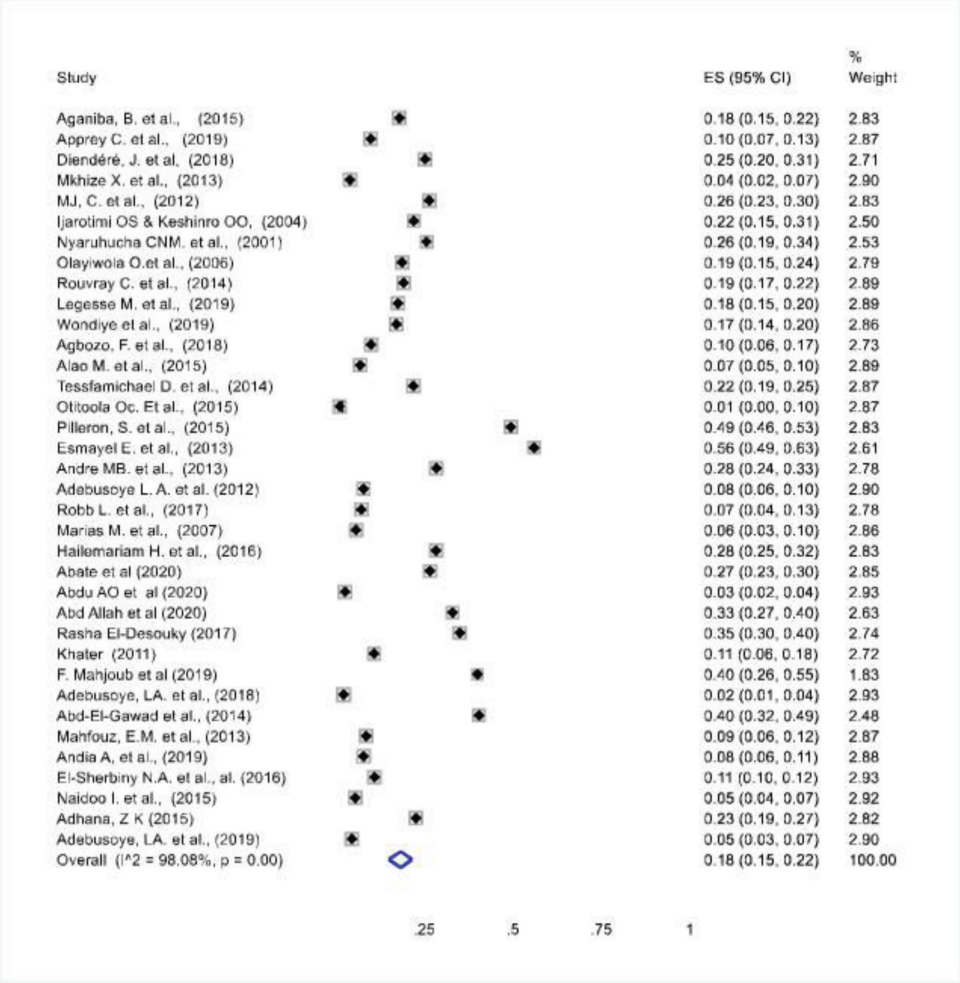

Figure 2 Forest plot displaying the pooled prevalence of undernutrition among old people in Africa. ES, effect size.

DISCUSSION

We conducted this review paper with the intention of estimating the pooled prevalence of malnutrition disaggregated by relevant factors such as study setting, screening tool and so on. According to the findings, the prevalence of malnutrition ranges from 4.0%[49] to 77.3%[33] across countries, depending on the assessment tools used and the study settings. These prevalence figures are consistent with previous European estimates of 3.8%–67.4%[19 21] among older people despite differences in the settings. In contrast, the highest risk of malnutrition was observed in the community-dwelling old people assessed by the MNA (both full and short forms) than in other studies: 7.5%–77.3% vs 5%[18] to 19%.[67] The variation may be due to the economic variables of the countries.

Overall, undernutrition was 17.1% in the African continent using BMI, which is comparable with European countries (3.8%–18.2%)[21]; while 27% of the study participants in the continent were overweight or obese. Furthermore, many studies (n=14) in our review used BMI as a nutritional assessment tool for old people. Similar studies in Africa still preferred to use BMI for old people where 19.9% and 30% of subjects were undernourished, overweight or obese, respectively.[68]

However, the BMI cut-off point used to identify underweight can have a significant impact on prevalence estimates, which tend to misclassify the elderly with physical spinal deformities and other factors that can affect height measurements.[69] Due to such measurement errors encountered, the assessment of nutritional status in the old people becomes a challenging task, which warrants more comprehensive and multidimensional assessments including clinical examination, anthropometric measures, laboratory tests, dietary surveys and social aspects.[70 71] This means one assessment tool may not be suitable for all settings, which need contextualisation.[18] Though more than 22 best-validated nutrition screening tools were identified for older adults,[17 19] there has long been a lack of consensus regarding the criteria needed to make a diagnosis of malnutrition.

On the other hand, the meta-analysis revealed a pooled prevalence of malnutrition of 18% (95% CI: 15% to 22%; p<0.001). This is in the range of the ones reported from the world, ranging from 0.8% to

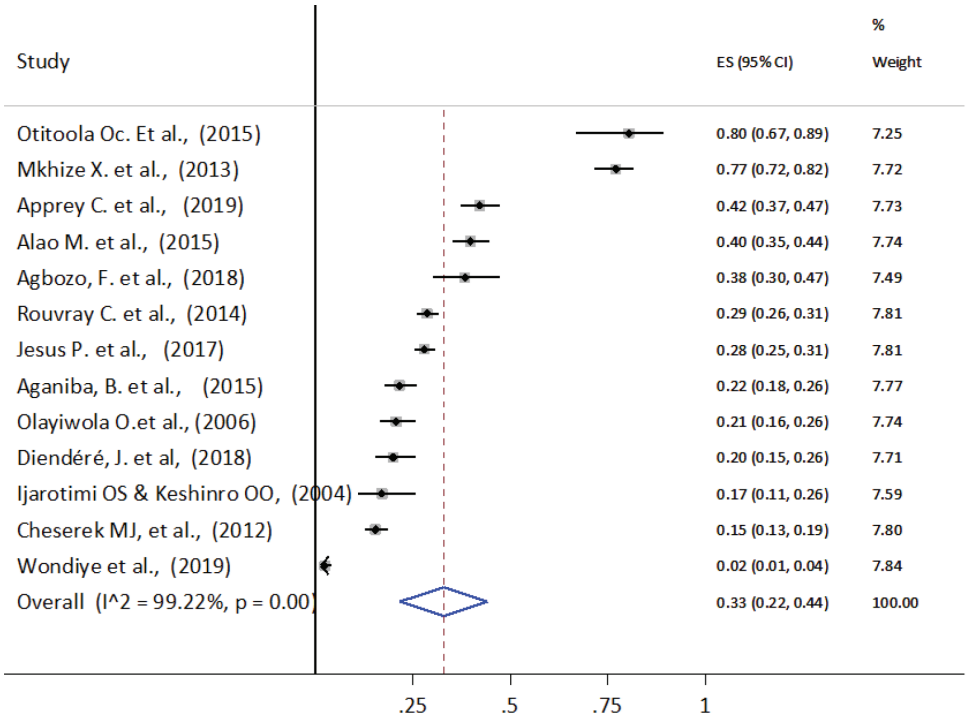

Figure 3 Forest plot displaying the pooled prevalence of overnutrition among old people in Africa. ES, effect size.

24.6%[72] depending on the study regions, settings and assessment tools used. The increasing number of an ageing population in Africa and nutritional transitions might have contributed to a higher burden of malnutrition. Our estimate is also consistent with the pooled prevalence of Indian studies (18.29%; 95% CI: 15.24% to 21.57%).[73] However, the result is slightly higher than the prevalence of malnutrition reported from the Central Demographic Republic of Congo and Nigeria (14.5%; 95% CI: 0.0% to 40.4%).[72] This disagreement could be explained by the use of various assessment procedures and the merging of pooled estimates from two countries where the burden of malnutrition might be higher.

Surprisingly, the current prevalence estimate is lower than the reviews reported from older European persons (48.4%; 95% CI: 41.5% to 51.8%).[19] The disparity could be attributed to economic factors, health literacy and healthcare access, and the majority of the previous review data came from hospital settings, implying that individuals with higher health risks were included.

Still, there was significantly high heterogeneity between the studies (Q=1873.99; df=36; p<0.001; τ^2=0.01; I^2=98.1%). Sensitivity analysis did not improve this heterogeneity, which is consistent with other previous findings.[18 72] Because of the highly complex physiological, social and temporal nature of malnutrition, which differs from person to person, as well as bias introduced

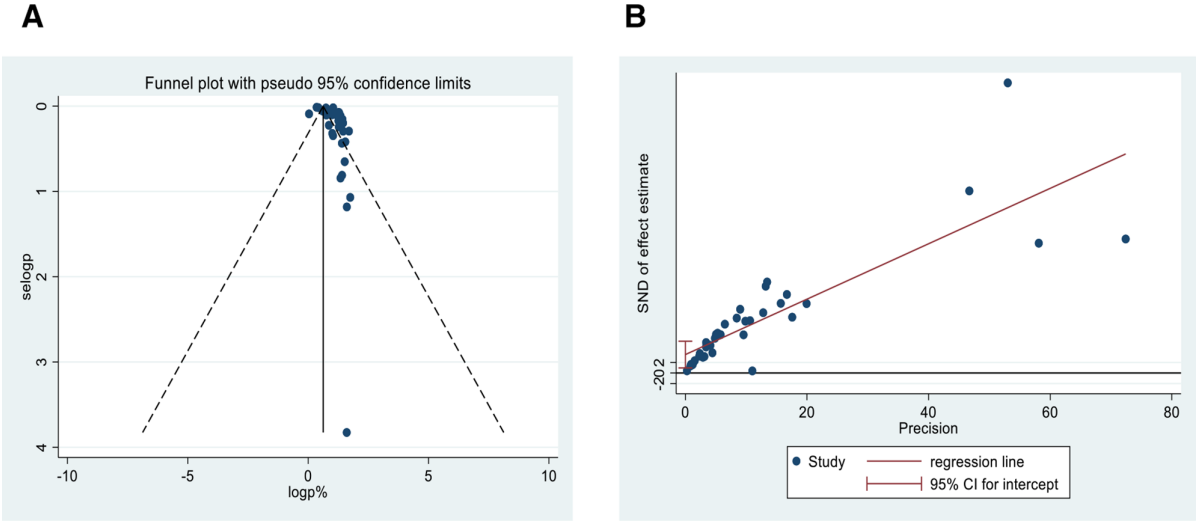

Figure 4 Probability of publication bias for included studies: (A) funnel plot and (B) Egger's publication bias plot.

Table 1 Subgroup analysis for the prevalence of malnutrition among old people, 2021

Subgroup	Number of studies included	Prevalence with 95% CI	Cochran's Q statistics for heterogeneity	P value	I^2
Regions					
Northern Africa	8	2.82 (2.72 to 2.92)	3.93	0.788	0.0%
Western Africa	10	2.46 (1.95 to 3.11)	263.06	<0.001	96.6%
Central Africa	3	3.76 (3.22 to 4.39)	2.08	0.354	3.7%
Eastern Africa	10	3.46 (2.29 to 5.22)	312.49	<0.001	97.1%
Southern Africa	5	1.79 (1.41 to 2.26)	60.54	<0.001	93.4%
Between groups			42.08	<0.001	
Study settings					
Community	21	3.12 (2.66 to 3.67)	829.56	<0.001	97.6%
Hospital	11	2.12 (1.67 to 2.70)	132.88	<0.001	92.5%
Long-term care	3	2.34 (2.08 to 2.63)	0.31	0.859	0.0%
Elderly daycare centre	1	1.04 (0.87 to 1.24]	0.00	–	–
Between groups			86.79	<0.001	
Assessment tools					
BMI	16	2.98 (2.37 to 3.75)	213.68	<0.001	93.0%
NCL	1	5.74 (0.71 to 46.74)	–	–	–
MNA	15	2.45 (2.11 to 2.85)	264.09	<0.001	94.7%
MNA-SF	4	2.45 (1.96 to 3.06)	136.91	<0.001	97.8%
Between groups			2.76	0.430	
Age group					
≥60	26	2.54 (2.17 to 2.98)	1102.79	<0.001	97.7%
≥65	10	3.54 (2.32 to 5.41)	361.43	<0.001	97.5%
Between groups			2.06	<0.001	
Morbidity					
One	7	1.66 (1.46 to 1.89)	91.58	<0.001	93.4%
Multiple	16	2.84 (2.50 to 3.22)	205.87	<0.001	92.7%
Not reported	13	3.16 (2.62 to 3.80)	36.06	<0.001	66.7%
Between groups			16.44	<0.001	
Overall	37	2.77 (2.43 to 3.16)	1573.48	<0.001	97.7%

BMI, body mass index; MNA, Mini Nutritional Assessment; MNA-SF, Mini Nutritional Assessment-Short Form; NCL, Nutritional Screening Checklist.

by research design, analysis of the pooled prevalence of malnutrition is difficult to account for all sources of variation.[74]

In case of subgroup analysis, the frequency of malnutrition showed a great variation depending on the study regions, study settings, age groups and clinical conditions of study participants. Malnutrition was found to be prevalent in Central Africa (3.76%), in older age groups (3.54%), with no documented clinical condition (3.16%) and in community dwellers (3.12%). The prevalence was statistically significant in all subgroups except between the assessment tools used (p=0.430). These findings are consistent with the reviews from India[73] and the rest of the world,[72] while the meta-regression identified the study setting as a statistically significant (adjusted R^2=39.20%, p=0.049) predictor of malnutrition prevalence. This is, however, different from the reviews conducted in India[73] and the world[72] where the study region (R^2=27.1%, p=0.026) and assessment tools (R^2=76.47%, p<0.001) were statistically significant predictors of the malnutrition prevalence, respectively. The variation might be due to the difference in assessment tools used between the studies.

Strength and limitation

To our knowledge, this is the first systemic review and meta-analysis that provides a comprehensive estimate of the prevalence of malnutrition among old people in Africa, including more recent studies conducted in the continent. Even though this review has its strengths, it is not without limitations. Due to the inherent heterogeneity among the included studies (I^2=98.08%), the interpretation of the current study needs precaution. Being limited to including only English literature and not including research published in books, magazines and others might limit the generalisability of the estimate.

CONCLUSION

This systematic review and meta-analysis showed high malnutrition prevalence among old people, which warrants a targeted policy intervention. The prevalence

varied greatly depending on the study setting, the tool used and the country of residence. Due attention to geriatric nutrition is mandatory, and to better monitor and evaluate, the use of a more reliable, valid and standardised malnutrition assessment tool is strongly recommended.

Contributors The study was created and designed by AMS under the supervision and approval of NF. AMS is responsible for all parts of this work. The final manuscript was read and approved by both writers.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not required.

Ethics approval Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article or uploaded as supplemental information.

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