NUTRITIONAL STATUS RESEARCH IN UGANDA: A CRITICAL REVIEW AND TREND ANALYSIS

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ABSTRACT

Uganda is ranked 77th out of 95 countries in terms of under-nutrition prevalence. Under-nutrition is closely linked to 40% of all mortalities among children below 5 years of age. It is projected that by 2050 malnutrition in all its dimensions combined will cost the country US $ 7.7 billion (19 trillion Uganda Shillings) in lost productivity, yet timely investing in nutrition would translate into an economic gain of US$ 1.7 billion (4.3 trillion Uganda shillings) through enhanced productivity. A critical review and trend analysis, following the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) approach was carried out. This was aimed at critically assessing the status of nutrition and identifying existing research gaps and intervention options. In addition, the study was focused on generating evidence for nutrition policy discourse. The review mainly focused on peer reviewed publications, covering the period from 2011 to 2022. A total of 215 materials were downloaded, 28 articles were used for literature review and 14 were used for further synthesis and trend analysis. It was found that stunting among children under 5 years was higher in the rural areas (37%) than in the urban areas (34%). Wasting and underweight among the same age group were most rampant in northern region, with prevalence rates of 7.5% and 14.6%, respectively, while stunting was most prevalent in western region (33.2%). Available data showed increasing prevalence of obesity and overweight. The proportion of women 15-49 years who were overweight or obese increased from 17% in 2006 to 19% in 2011 and 24% in 2016. On the other hand, prevalence of thinness among women aged 15-49 years declined from 12% in 2006 and 2011 to 9% in 2016. The review unearthed dearth of literature on nutrition for the elderly, adolescents and young adults. It would be prudent to invest in research to bridge the identified gaps. The outcome of such studies would be instrumental in informing nutrition policy in Uganda.

Key words: Stunting, Obesity, Underweight, Overweight, Micronutrient deficiency

INTRODUCTION

Uganda faces multiple nutritional burdens namely obesity, overweight, under-nutrition, micronutrient deficiency and non-communicable diseases [1], yet a range of food products are produced in the country [2]. It is ranked 77th out of 95 countries in terms of undernourishment [3]. Under-nutrition is closely linked to 40% of all mortalities among children below 5 years of age [4].

The high prevalence of malnutrition in Uganda is attributed to underlying factors such as poverty, disease, ignorance, cultural taboos [2], poor diet and effects of parasites [5]. Similarly, about 40% of schools do not undertake feeding programmes; 92% of the rural children go to school without breakfast and 70% do not eat lunch at school [6]. Poor nutrition among children weakens human capital development potential through reduced physical productivity and distorted cognitive ability [4, 7]. In addition, 22% of income is lost annually due to malnutrition cases among adults, which leads to impaired physical ability, reducing capacity to contribute to productive activities such as agriculture, the main economic activity in the country [8].

Total losses due to malnutrition was estimated at 1.8 trillion Uganda shillings in 2009, which was approximately 5.6% of the Gross Domestic Product (GDP) [9]. It is projected that malnutrition in all its dimensions combined will cost Uganda US $ 7.7 billion (19 trillion Uganda shillings) in lost productivity by 2050, yet timely investing in nutrition would translate into an economic gain of US$ 1.7 billion (4.3 trillion Uganda Shillings) through enhanced productivity [10].

It is, therefore, important that nutrition is considered a key factor affecting Uganda's socio-economic development. While several review studies have been done on nutrition in Uganda [1, 8,11-15], few had a comprehensive scope, especially in recent times. Some of the studies reviewed are majorly grey literature and mainly focused on qualitative synthesis, rather than a quantitative trend analysis. This review and trend analysis were undertaken to critically assess literature on nutrition status, to identify gaps in knowledge on nutrition status and to provide evidence that can be used for formulation of nutrition policy in Uganda. This article focused on the period 2011-2022 to capture recent developments in the nutrition arena in Uganda and to minimize duplication with an earlier review by Shivaley & Hao [15], published in 2012 covering thematic areas of agriculture, food security and nutrition as well as trends between 1990 and 2010.

Given the gaps in previous review studies, in addition to the significance of nutrition and its dynamism in both space and time, it was important to undertake a comprehensive review of literature to bridge the void. This paper, therefore, sought to contribute to the body of knowledge by conducting a rigorous critical review and trend analysis on nutrition status in Uganda. The specific primary outcome of the study included; stunting, wasting, underweight, overweight, obesity, anaemia and major emerging issues in nutrient adequacy.

METHODOLOGY

This review study followed the systematic literature search process based on the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) approach and entailed two stages; i) scoping and critical review of studies on nutrition status in Uganda, and ii) analysis to synthesize the content and derive trends. The review was limited to articles published in the period January 2011 - January 2022 and focused on peer reviewed publications and publications from government departments and United Nations (UN) agencies. The following search engines were used for the literature search: Mendeley web, Google scholar, PubMed, Web of science, Scopus, and Sciencedirect.com. Other sources included relevant reports from website of reputable bodies such as Uganda Bureau of Statistics (UBOS) and Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) and international institutions such as Food and Agriculture Organization of the United Nations (FAO). Articles published before the study time scope were excluded. Similarly, unpublished non- PhD theses were excluded from the study, even those that were conducted within the study period.

The key search words used included "nutritional status and Uganda", "under nutrition/undernourishment and Uganda", "stunting and Uganda", "wasting and Uganda", "underweight and Uganda", "overweight and Uganda", "obesity and Uganda", "nutrient adequacy and Uganda" and "anaemia and Uganda" The list of key terms was flexible to widen the scope of the literature review but without losing focus of primary outcome of the study.

A total of 215 materials were downloaded. After a thorough scanning (especially the titles, abstracts, methods, results, discussions and conclusions) for appropriateness to provide relevant content for the different sections of the manuscript, 28 materials were used for literature review and 14 of the reviewed articles were found relevant for trend analysis and/or critical assessment of statistical methods employed. All duplicates of documents were omitted. For further validation, results were compared with findings from Uganda Demographic

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and Health Surveys (UDHS). The actual reported means from various studies were extracted and used for comparisons across different regions, locations (rural versus urban) and for trend analysis.

RESULTS AND DISCUSSION

Results and discussion of trend analysis of previous literature
Of the 14 studies (Table 2) subjected to trend analysis and/or critical assessment of statistical methods employed, 6 studies focused on infants and young children, two covered school-age children, three focused on household level, one study investigated malnutrition among adults living with Human Immunodeficiency Virus (HIV), one study focused on women living with HIV and one study looked at nutrition research gaps in Uganda. By geographical scope, five studies covered the entire country, three focused on eastern region, two studies covered northern and southwestern region, one study covered western region, while two studies focused on central region and one targeted ministries, departments, agencies and Non-Governmental Organisations (NGOs). The sample sizes ranged from 122 to 20,880. By data type, five studies used panel/cohort data and nine used cross-sectional data.

Gaps in methodology of previous studies in Uganda
The criteria of critique used in the review included the data analysis models used (econometric, statistical and biometric), sample size, anthropometry, nutritional indicators, and presentation of results (disaggregation by gender and location).

Generally, robust methods have been applied in nutrition research in Uganda (Table 2). However, more efficient and consistent methods need to be adopted, for instance, panel regression models (logit regression, Hausman test, random effects regression and fixed effects model). In addition, causality needs to be further explored since most studies focused on deterministic analyses which are necessary but not sufficient. Similarly, policy inclined models such as sensitivity analyses need to be explored in future studies. Lastly, more policy focused qualitative studies need to be conducted.

A study on maternal employment and child nutritional status in Uganda [16] used a representative sample (n=3,531) and an appropriate methodology; Pearson's correlation, multiple linear regression model and descriptive statistics, but had some gaps. For example, obesity/overweight as a key variable in children nutrition was not investigated. Further, results were not disaggregated by gender, and the anthropometric classification (age bracket of the children being studied) was not

clearly spelt out. The same gaps (apart from the anthropometry) were exhibited in a study on prenatal dietary diversity influence on underweight in infants [17], which as well used a large sample size (n=3,291), cox regression model and descriptive statistics. In addition, Bwenge *et al.* [18] used a fairly representative sample (n=506) in a study on effects of complementary feeding on attained height among lower primary school-aged children in eastern Uganda, applying Chi-square test which is necessary but not sufficient as a statistical model. Overweight, underweight and wasting were not investigated in this study. The focus was on stunting and complementary feeding, and the results were not gender disaggregated.

Nakakawa *et al.* [3] investigated food and nutrition status of households with women living with HIV in Uganda using a representative sample (n=4,254) covering the entire country. However, the methodology (descriptive statistics - frequencies, t-test and ANOVA) did not explore causality exhaustively. The study also excluded other gender (men and youths including children). Lastly, a study on stunting of children concurrent with wasting or overweight prevalence [19] had a valid methodology (multilevel mixed effect logistic regression and Chi square test). However, results were not disaggregated by gender and location.

Nutritional status in Uganda from previous literature
Several studies have been conducted on various dimensions of nutrition (Table 3). Of these, 5 investigated wasting, 4 measured stunting and the least studied indicators were vitamin A deficiency, anaemia and minimal acceptable diet (MAD) each covered by 2 studies. By anthropometry, the most studied age category was < 6 months (4 studies), followed by 6-24 months (3 studies). The age groups of 5-11 years and 15-49 years each were covered by 2 studies, while the least studied was the age bracket of 24-35 months (one study). Adults older than 59 years were not investigated among the analysed studies.

Generally stunting reduced with age with exception of 6-24 months which may be attributed to post-breastfeeding shocks as the infants are introduced to solid foods (Table 3). This finding agrees to that of Madzorera *et al.* [17] who reported increased stunting from 27.1% at 3 month visit to 29.7% at 6 months, then 35.6% at 9 months and 39.4% at 12 months [16]. On the contrary, a study by Mawa & Lawoko [30] reported a steady increase in incidence of stunting between 6-35 months, from 16.5% to 46%. This was followed by a decline between 36 and 59 months (from 35.9% to 33.4%). There was no significant variation in proportion of underweight (11-12.1%) between 0 and 59 months from the 3 sources of literature (Table 3). Wasting fluctuated among the various age groups (Table 3), but to a

greater extent reduced with age. This is in agreement with findings by Mawa & Lawoko that indicated fluctuation in wasting for instance between 6-11 months (11.2%), 12-23 months (5.57%), 24-35 months (2.12%), 36-47 months (1.76%) and 48-59 months (2.80%).

A study by Turyashemererwa *et al.* [20] reported increase in obesity prevalence with age (Table 3). Women suffered more from obesity (29%) compared to men (9%) [21]. In addition, the prevalence of overweight and obesity among people living with HIV was higher among females (55%) than males (30%) [28]. A study in Bududa, Eastern Uganda reported that during food abundant seasons males were more malnourished than females, 51.4% stunted, 55.8% underweight and 71.4% wasted; while females were more malnourished than males during food-poor seasons, 58.3% (stunted), 69.2% underweight and 57.1% wasted [29].

Nutritional status of under-5 age group disaggregated by region
Stunting among infants and young children (under 5 years) was most prevalent in western Uganda (33.2%) followed by northern Uganda (30.3%). Wasting was most rampant in northern region (7.5%). Underweight was more prevalent in northern Uganda (14.6%) followed by western with 11.7% [16] (Table 4).

Nutritional status among rural and urban populations
Four studies investigated stunting in both rural and urban areas. Wasting and underweight were each investigated by 3 studies, while obesity and anaemia were each covered by 2 studies (Table 5).

Stunting among children under 5 years was generally higher in the rural areas (37%) compared to the urban areas (34%) (Table 5). Similarly, wasting was more prevalent among children in the rural areas (6%) than those in urban areas (5%). Wasting among women of reproductive age (15-49 years) stood at 12.9% in rural areas and 7% among urban dwellers (Table 5). In addition, underweight was more prevalent among rural children than those in urban areas. However, there was no difference in underweight among females in rural and urban areas both at 7%. Generally, obesity was more prevalent in urban areas than rural areas. This agrees to a report by National Planning Authority (NPA) and World Food Programme (WFP) [24] that indicated that overweight was mainly an urban problem, despite a general increase from 8% in 1995 to 19% in 2011. Obesity among women generally declined from 10.6% in 2001 to 4.1% in 2011.

Trends of nutritional status of children in Uganda

Trend analysis of results reported on stunting, underweight, wasting and overweight was done over the period from 2000-2016, mainly using UDHS extracts as shown in Figure 1. The UDHS results for 2021 have not been published yet.
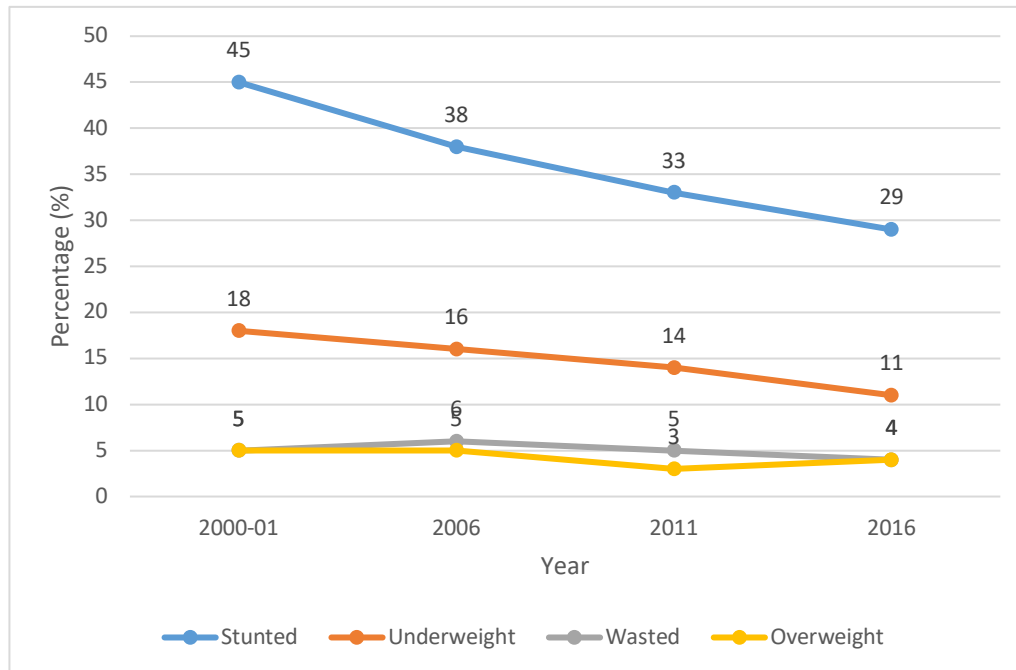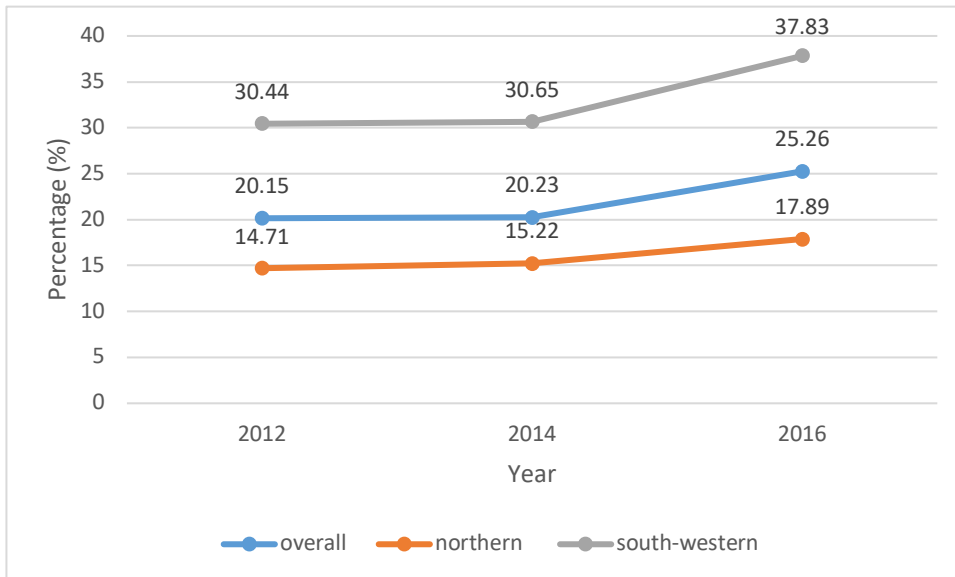

Figure 1: Trends of nutritional status of children in Uganda
          Data extracted from UBOS [20]

In 2000-2001, stunting among children stood at 45%. It decreased to 38% in 2006, then to 33% in 2011 and further decreased to 29% in 2016. Similarly, the proportion of underweight children reduced, from 18% in 2000-2001 to 11% in 2016. However, rates of wasting and overweight remained constant (Figure 1). It is worth noting that the 2000-2001 UDHS sample size did not consider 11 districts (approximately 5% of the country) namely; Amuru, Nwoya, Bundibugyo, Ntoroko, Gulu, Omoro, Kasese, Kitgum, Lamwo, Agago and Pader. This must have affected the quality of results [21].

Conversely, a study that used panel survey data of 2012, 2014 and 2016 revealed that stunting among children under-five years of age steadily increased in both northern and south-western regions [26]. Between 2012 and 2016, the rate of stunting increased by 3% in northern Uganda and by 5% in south-western [26]. Overall, the percentage of children who were stunted in 2016 were 25%, which was 4% below the national 2012 average of 29% (Figure 2) [26].

Figure 2: Trends in stunting among under-5 children by region
Data extracted from Namulondo & Bashaasha [26]

Trends in women's nutritional status in Uganda
Obesity/overweight among women of reproductive age was analysed from 2006 to
2016 using results from UDHS 2016 (Figure 3). No reports with data on the trend
of women's nutritional status in Uganda between 2016 and 2021 were found.
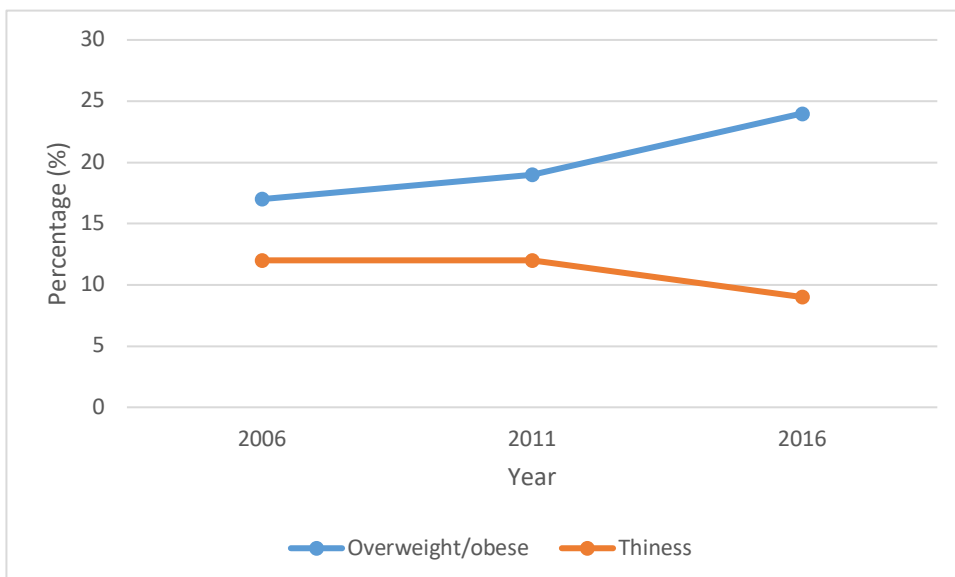
Figure 3: Trends in women's nutritional status in Uganda
Data extracted from from UBOS [20]

The proportion of women who were overweight or obese increased from 17% in
2006 to 19% in 2011 and 24% in 2016. In addition, the prevalence of thinness

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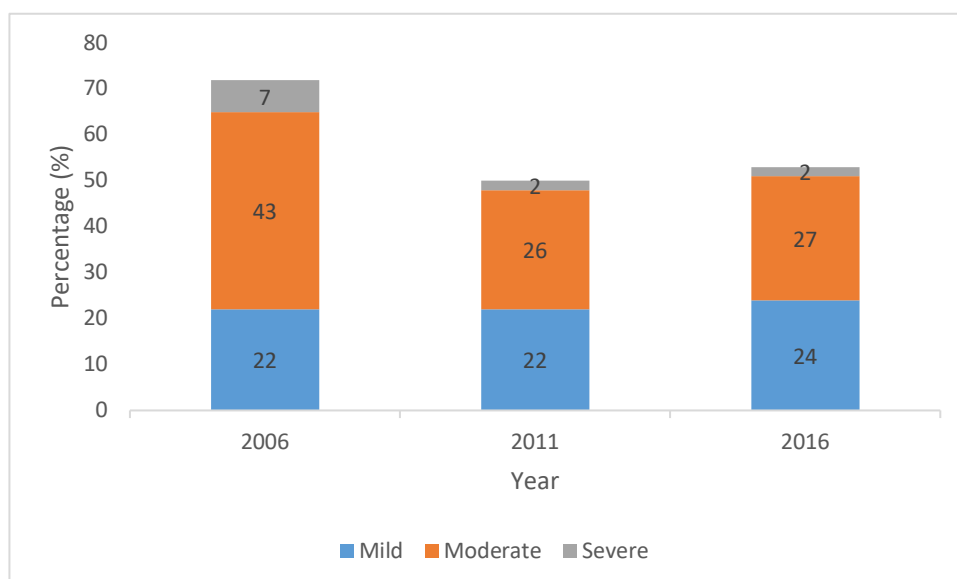among women of age 15-49 years declined from 12% in 2006 and 2011 to 9% in 2016 (Figure 3).

Micronutrients: Status and imbalances among women of reproductive age
Micronutrient deficiencies, commonly referred to as "hidden hunger"[7], are widespread in Uganda, the most prevalent being goiter, vitamin A deficiency and anaemia, especially among women of reproductive age during pregnancy and lactation [5].

The majority of women of reproductive age (WRA) in Mbarara district were reported to consume a diversified diet of animal and plant micronutrient sources but folate intake was considerably low, explaining the high prevalence of non-transmittable diseases (NTDs) [27]. Higher maternal dietary diversity during pregnancy was linked to lower risk of suffering from infant underweight as opposed to stunting and wasting [17]. Approximately 24% of WRA living in rural areas was found to be anaemic compared to 20% of their urban counterparts. Wasting affected 13% of WRA in rural areas and 8% in urban areas [3].

The incidence of anaemia among children 6-59 months of age
Aneamia among children of 6-59 months of age was analysed from 2006 to 2016 using results from UDHS 2016 (Figure 4). However, there is insufficient literature and data on the trend of anaemia from 2016 to 2021. The incidence of anaemia dropped drastically from 72% in 2006 to 50% in 2011, and then a slight upswing to 53% in 2016 (Figure 4). Generally, anaemia mainly existed in mild and moderate forms.


Figure 4: The incidence of anaemia among children aged (6-59 months)

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Data extracted from UBOS [20]

Trend in anaemia status among women of reproductive age (15-49 years)
Anaemia among WRA (15-49 years of age) was analysed from 2000 to 2016 using results from UDHS 2016 (Figure 5). The prevalence of anaemia had a slight upward swing from 2000-2001 (37%) to 43% in 2006 and then a down turn in 2011 (24%). It then increased in 2016 to 32% as shown in Figure 5 [21]. The 2000-2001 UDHS sample excluded the districts of Amuru, Nwoya, Bundibugyo, Ntoroko, Gulu, Omoro, Kasese, Kitgum, Lamwo, Agago and Pader, which constitute 5% of the country's population [21].
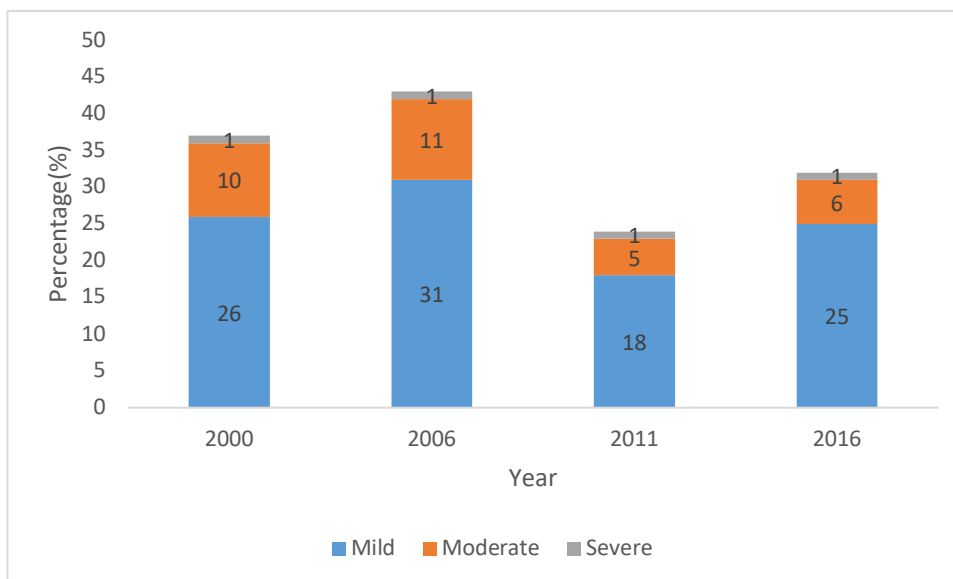
Figure 5: Trends in anaemia status among women of reproductive age group (15-49 years)
Data extracted from UBOS [20]

Available nutrition data in Uganda, their strength and weakness
The main national representative data in Uganda are UDHS, Uganda Demographic and Health Survey and UBOS UNPS (Uganda National Panel Survey) and FAO STAT among other data sources. The data sets have multidimensional strength and weaknesses (Table 5).

CONCLUSION

The reviewed literature revealed that all facets of the triple burden of malnutrition (over-nutrition, under-nutrition and hidden hunger) remain persistent in Uganda, with upward trend of over-nutrition. The literature also revealed higher prevalence of malnutrition among rural than urban populations and differences in malnutrition

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rates among the major geographical regions of the country. However, there is a paucity of data, especially between 2016 and 2021, with major gaps in research on age groups such as adolescents, lactating mothers, the elderly and pregnant mothers. Similarly, there is scarcity of data regarding underlying factors associated with obesity and chronic diseases and on the nexus between nutrition and physical exercise as well as COVID-19 and nutrition. A further noteworthy observation is the contradiction in results from region-specific studies and government statistics provided by UDHS. There is a need for region specific studies to validate results on nutrition status. This review can be used as a basis for guiding nutrition research and nutrition programming since it identifies the research gaps and the prevalence of the different forms of malnutrition.

Conflicting Interest
The authors would like to declare that there is no any conflicting interest.

Credit Authorship Statement:
Brian Ogenrwoth: Ideation, Literature search, critical analysis, methodology, writing original manuscript
Grace Akumu: Ideation, methodology and review of manuscript
Johnny Mugisha: Ideation, writing-review, editing and supervision
John H. Muyonga: Ideation, writing-review, editing and supervision

Table 1: Summary of previous review studies in Uganda (2016-2021)

Author/Year	Focus of Review	Gaps	Emerging Issues
Ngaruiya *et al.* [1]	Obesity as a form of malnutrition	Mainly qualitative synthesis	The burden of obesity is increasing and deserves further investigation
Adebisi *et al.* [8]	Malnutrition among children	Focused mainly on children, leaving out other age groups.	Malnutrition has a marked impact on socio-economic development of children
Bongomin *et al.* [11]	Anaemia among pregnant women	Focused only on pregnant women	Anaemia poses a significant public health risk and has nutritional causes
Namugumya *et al.* [12]	A mechanisms-based explanation of nutrition policy (dis) integration processes in Uganda	Mainly qualitative analysis: synthesis of policy documents and focus group discussions (2001-2017)	Investment in nutrition enhances policy integration and effective service delivery
Namugumya *et al.* [13]	Towards concerted government efforts: Assessing nutrition policy integration in Uganda	Focused on review, mainly of policy documents (2001-2017)	Nutrition has been under addressed in Uganda
Rukundo [14]	Food and nutrition situation	Mainly reviewed grey literature (reports) from 2002 to 2015.	Malnutrition is dynamic and lacks data

Shivaley & Hao [15]	Agriculture, food security and nutrition	Wide theme of focus hence nutrition specific review, not exhausted. Focused on trends between 1990 and 2010	UDHS and Uganda National health surveys are credible sources of nationwide data.

Table 2: Summary of key literature cited and analysed

Author(s)/year	Research goal/focus	Geographical scope	Analysis method	Sample size	Data type
Nahalomo *et al.* [29]	Malnutrition and associated risk factors in a land-slide prone area	Bududa, Eastern Uganda	Descriptive statistics, Pearson's Chi square, bivariate and multivariate logistic regression	422	Cohort study
Nalugga et al. [28]	Overweight and obesity among people living with HIV	Kampala	Descriptive statistics, Poisson regression	296	Cross-sectional
Iversen *et al.* [19]	Child stunting concurrent with wasting or overweight in Uganda	Uganda	Chi-square test of independence, multi-level mixed effect logistic regression model	307	Panel survey (Cohort study)
Ford *et al.* [23]	Integrated enhanced infant and young child feeding (IYCF) and micronutrient powder intervention improved select IYCF practices	Eastern Uganda (Amuria, Soroti)	Linear mixed models, difference-in-difference	2816	Cross-sectional

Madzorera et al. [17]	Influence of prenatal dietary diversity on underweight in infants	Northern and south-western	Cox regression analysis, descriptive statistics	3291	Panel survey (Cohort)
Nakakawa et al. [3]	Food and nutrition status of households with women living with HIV in Uganda	Central, northern, eastern and western (32 districts)	Analysis of variance, t-tests, descriptive statistics	4,254	Cross-sectional
Namulondo & Bashaasha [26]	Panel data analysis of a crop diversification strategy	Northern and southwestern	Z-test, Poisson fixed effects regression, descriptive statistics	3597	Panel data
Bwenge et al. [18]	Effects of complementary feeding on attained height among lower primary school-aged children	Eastern (Mbale district)	Bivariable and multivariable regression analysis, sensitivity analysis, descriptive statistics,	506	Community based prospective cohort study
Nankinga et al. [16]	Maternal employment and child nutritional status in Uganda	Uganda	Multiple logistic regression model, Pearson's Chi square, descriptive statistics	3531	Cross-sectional

Isingoma et al. [4]	Socioeconomic and demographic factors influencing feeding practices, morbidity status, and dietary intakes of children aged 7 – 24 Months	Midwestern (Masindi)	Chi-square test of independence, descriptive Statistics	636	Cross-sectional
Lubogo & Orach [22]	Stakeholder perceptions of research options to improve nutritional status in Uganda	Ministries, NGOs, agencies	Qualitative analysis, descriptive statistics	16	Cross-sectional
Turyashemererwa et al. [20]	Prevalence and risk factors for anaemia among school children aged 5 – 11 years	Wakiso district (Central Region)	Logistic regression, principal component analysis, descriptive statistics	122	Cross-sectional
UBOS [21]	Uganda Demographic and Health Survey 2016	Uganda	Descriptive statistics, trend analysis	20,880	Cross-sectional
Mawa & Lawoko [30]	Malnutrition among children under 5 years	Uganda	Chi-square and multivariate analysis	10,086	Cross-sectional

Table 3: Summary of results of nutritional status from previous literature

Nutrition indicator	Age group affected	Location	Sample size	Results	Source
Stunting	< 6 months	Eastern (Mbale district)	506	11.8%	[18]
	6-24 months	Northern & south-western	3291	39.4%	[17]
	6—24 months	Entire country	307	41%	[19]
	24-35 months	Northern & South-western	3291	36.8%	[17]
	6-59 months	Entire country	20,880 households	29%	[21]
	5—11 years	Entire country	307	31%	[19]
Underweight	0—6 months	Entire country	3531	12%	[16]
	6-24 months	Northern & South-western	3291	12.1%	[17]
	6-59 months	Entire country	20,880 households	11%	[21]
Wasting	0—6 months	Entire country	3531	7%	[16]
	6—24 months	Entire country	307	4.3%	[19]
	6—24 months	Northern & South-western	3291	5.3%	[17]

	6-59 months	Entire country	20,880 households	4%	[21]
	5--11 years	Wakiso district	122	50%	[20]
	5-11 years	Entire country	307	0.35%	[19]
Overweight/ Obesity	0—6 months	Entire country	20,880 households	4%	[21]
	6—24 months	Entire country	307	4.25%	[19]
	6—59 months	Entire country	20,880 households	4%	[21]
	5—11 years	Entire country	307	9.3%	[19]
	Women:15-49 years	Entire country	20,880 households	29%	[21]
	Men: 15-49 years	Entire country	20,880 households	9%	[21]
	Women:36-59 years	Kampala	296	55%	[28]
	Men: 36-59 years	Kampala	296	30%	[28]
Vitamin A Deficiency	< 5 years	6 stakeholder groups (Entities)	16 (Qualitative Analysis)	35.8%	[22]

	6—59 months	Entire country	20,880 households	9%	[21]
Anaemia	6—59 months	6 stakeholder groups (Entities)	16 (Qualitative Analysis)	50%	[22[
	9-11 months	Entire country	20,880 households	78%	[21]
	Women: 15-49 years	Entire country	20,880 households	32% (1 in 3)	[21]
	Men: 15-49 years	Entire country	20,880 households	16%	[21]
	WRA	Entire country	16 (Qualitative analysis)	1 in 4	[22]
Minimal Acceptable Diet	6—23 months	Eastern Uganda (Amuria, Soroti)	2816	14.6%	[23]
	6—23 months	Entire country	20,880 households	15%	[21]

Table 4: Nutritional status in infants under 5 years in Uganda

Region	Nutrition status (%)		
	Stunting	**Wasting**	**Underweight**
Central	24.5	2.1	7.2
Eastern	25.1	3.5	9.3
Northern	30.3	7.5	14.6
Western	33.2	2.8	11.7

Data extracted from Nankinga *et al.* [16]

Table 5: Summary of results of nutritional status in Uganda disaggregated by location

Nutrition indicator	Age group affected	Rural areas	Urban areas	Source
Stunting	IYC (age unspecified)	29.1%	24.1%	[16]
	6-59 months	30%	24%	[21]
	< 5 years	36%	19%	[2]
	< 5 years	37%	34%	[25]
Wasting	IYC (age unspecified)	4.1%	2.9%	[16]
	< 5 years	6.0%	5.0%	[25]
	Female adults (15-49 years)	12.9%	7.6%	[25]
Underweight	IYC (age unspecified)	11.3%	4.1%	[16]
	< 5 years	18.0%	17.0%	[25]
	Female: Adults	7%	7%	[3]
Obesity	Female: Adults	23%	33%	[3]
	Female: Adults	20%	34%	[21]
	Male: Adults	6%	16%	[21]
Anaemia	6-59 months	54%	48%	[21]
	< 5 years	50.9%	38.0%	[25]
	Adult: Women (15-49 years)	23.8	19.9	[25]

Table 6: Nutrition data available in Uganda

DATA SOURCE	STRENGTH	WEAKNESS
UBOS UNPS (LSMS)	Large data points covered therefore reducing possibility of collinearity. Wide range of anthropometric measurement to obtain nutrition and health variables.	Attrition of respondents may lower generalizability of findings in case respondents who stay in the study differ from those who fell out.
UDHS https://microdata.worldbank.org/index.php/catalog/2979/data-dictionary	Cross sectional and nationally representative with large sample size (ranging between 5000 and 30,000 households) and usually conducted every 5 years to allow comparison over time. Comprehensive in variable capture (anaemia, child health, child feeding practices, vitamin supplementation, anthropometry, anaemia, salt iodization).	Changes over time at individual/household level are not captured.
FAO STAT http://www.fao.org/faostat/en/#country/226	Dissemination is done once a year. Allows comparability over time in cases where methodology and classification of basic data don't change	Difference in methodologies and source of data for basic variables limits geographical comparability.
Uganda national NCD risk factor survey	Provides detailed data on non-communicable diseases at national and sub-national level	Requires further multivariate analysis to understand further casualty among variables
Global nutrition data set globalnutritionreport.org	Comprehensive data covering maternal, infant and young child nutrition, diet related non-communicable disease (NCD) targets.	Some variables captured are not representative at country level due to missing values.

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