Tropical Medicine and International Health doi:10.1111/tmi.12708

VOLUME 21 NO 6 PP 807–817 JUNE 2016

Gender and age disparities in adult undernutrition in northern Uganda: high-risk groups not targeted by food aid programmes

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Abstract

OBJECTIVE To determine the prevalence of adult malnutrition and associated risk factors in a post-conflict area of northern Uganda.

METHODS A cross-sectional community survey was performed from September 2011 to June 2013. All registered residents in Gulu Health and Demographic Surveillance System aged 15 years and older were considered eligible. Trained field assistants collected anthropometric measurements (weight and height) and administered questionnaires with information on sociodemographic characteristics, food security, smoking and alcohol. Nutritional status was classified by body mass index.

RESULTS In total, 2062 men and 2924 women participated and were included in the analyses. The prevalence of underweight was 22.3% for men and 16.0% for women, whereas the prevalence of overweight was 1.5% for men and 7.6% for women. In men, underweight was associated with younger (15–19 years) and older age (>55 years) ($P < 0.001$), being divorced/separated [odds ratio (OR) = 1.91 (95% confidence interval (CI): 1.21–2.99] and smoking (OR = 2.13, 95% CI: 1.67–2.73). For women, underweight was associated with older age ($P < 0.001$) and hungry-gap rainy season (May–July) (OR = 1.33, 95% CI: 1.04–1.69). Widowed or divorced/separated women were not more likely to be underweight. No association was found between education, alcohol consumption or food security score and underweight.

CONCLUSIONS Our findings are not in line with the conventional target groups in nutritional programmes and highlight the importance of continuous health and nutritional assessments of all population groups that reflect local social determinants and family structures.

keywords post-conflict, nutritional status, anthropometry, gender, community study

Introduction

When peace breaks out after a prolonged conflict, most humanitarian organisations pull out, while government systems often do not have the capacity to take over. New public health challenges can emerge in this post-conflict vacuum, including breakdown of infrastructure, changes in food supply and population migration [1]. Optimal nutritional status is important for work ability and enhancing independence to rebuild the area. Being underweight weakens the immune response, reduces physical and cognitive function and in turn affects morbidity and mortality [2–4]. Obesity is associated with a range of non-communicable diseases (NCDs), the largest burden of disease globally [5]. Adult malnutrition has long-term effects in terms of poor reproductive outcome and childhood growth of the following generation [6]. Lastly, poor health and well-being can trigger violence and lead to renewed conflict.

The effects of war and displacement on health and nutrition during conflict are well known [7, 8]. Moreover, previous studies have documented unintended negative consequences of humanitarian food assistance: in Guinea-Bissau, Ethiopia and the Democratic Republic of Congo, residents outside of camps and in rural areas have been neglected in relief interventions resulting in a higher prevalence of malnutrition in non-camp than in camp residents [9, 10]. In Guinea-Bissau and Ethiopia, unintended population movement to camps or feeding centres led to increased communicable diseases and mortality due to overcrowding and poor hygiene in these locations [9, 11]. Poor implementation of well-known interventions during

famine in Ethiopia resulted in food aid not getting to those who needed it [12, 13].

Few studies have focused on the post-conflict period where vulnerabilities and risk factors can persist or be substantially different. The nutritional studies in post-conflict settings that we could identify focused mainly on children <5 years of age [10, 14–19]. To ensure healthy populations of post-conflict settings, a better understanding of the magnitude and risk factors for adult malnutrition is therefore needed [7].

We report anthropometric data from a population that was subjected to one of the largest and longest food aid interventions in history. The objective was to determine the prevalence and associated risk factors for adult malnutrition in the post-conflict area of northern Uganda.

Methods

The conflict and post-conflict situation in northern Uganda

Northern Uganda experienced a prolonged armed conflict (1986–2006), resulting in large-scale population displacement, with families forced to leave their homes and traditional sources of livelihood and move into internally displacement persons (IDP) camps. At the peak of the conflict, 90% of the population were in IDP camps [20]. The United Nations World Food Programme (WFP) provided general food distributions to households registered in IDP camps from 1996 to 2008 [21]. A high prevalence of acute and chronic malnutrition among children <5 years was reported [22], but no studies were conducted on adult nutritional status. Other studies have shown high levels of mental illness, contributing to harmful health behaviours [23, 24] including risk behaviours for HIV [25]. Camp characteristics were also very similar to recognised risk factors associated with NCDs: unplanned rapid urbanisation; increased alcohol and tobacco consumption; decreased physical activity; and reduced diet diversity [26]. Northern Uganda has been in a post-conflict transition since signing a peace agreement in 2006. Local government officials put pressure on IDPs to return home resulting in another population movement from urban camp setups to rural homes of origin. The relocation to rural areas has created new challenges with reduced access to basic health care and education services [20]. Besides the persistent consequences for mental health and substance use [27], the return process has been marred by land conflicts, affecting all aspects of human security, including food security.

Study setting and population

The study was carried out within Gulu Health and Demographic Surveillance System (HDSS), of Gulu University, Uganda. Gulu HDSS was established in 2010 with the aim to provide a framework for monitoring demographic and health indicators in the post-conflict recovery process. It is located in rural Awach subcounty of Gulu district, northern Uganda, 370 km north of Kampala, the capital city of Uganda, and 30 km from Gulu Municipality. Awach sub-county covers about 250 km^2 that are divided into four administrative parishes, 13 villages and 67 sub-villages. An estimated 20 000 individuals were displaced to Awach IDP camp during the war. Awach camp officially closed in 2008. Although some residents were still in the process of resettlement, the majority of the population had moved to their ancestral homes and were scattered across the 250 km^2 at the time of the study. Based on Gulu HDSS census round 2, the total population of the study area was 16 532 people in 2012, with approximately 50% <15 years of age. The people of Awach are mainly peasant farmers. The majority belong to the Luo-speaking Acholi ethnic group with Christianity as the main religion, followed by a Muslim minority group.

Data collection

We carried out a cross-sectional community survey from September 2011 to June 2013. All registered individuals in Gulu HDSS aged ≥15 years were eligible to participate. Trained field assistants administered questionnaires in the local language, *Luo*, and performed anthropometric measurements. Interviews and measurements were carried out in privacy, by a field assistant of the same sex as the participant. The questionnaire included information on sociodemographic characteristics, food security, smoking and alcohol consumption. Food security was assessed using the food consumption score developed by WFP [28]. Data were collected on a 7-day recall of frequency of consumption of food groups. We constructed food groups based on locally available food items and local names. We used the cut-off points for poor, borderline and acceptable food security based on a population in Burundi whose characteristics are close to northern Uganda [29]. In northern Uganda, the hungry-gap rainy season is defined as the months of May to July, which is in the beginning of the rainy season and before the first harvest. At this time, food availability is low and agricultural physical activity levels are high. A locally adapted questionnaire of the WHO STEPwise Approach to Chronic Disease

Risk Factor Surveillance was used to obtain information on smoking and alcohol consumption [30].

Nutritional status

The anthropometric measurements, weight and height, were taken on participants wearing light clothes and without shoes. Weight was measured to the nearest 0.5 kg by a mechanical flat scale, Seca 762, supplied by the Kampala-based Joint Medical Stores accredited by the Ugandan Ministry of Health and the Uganda Bureau of Statistics (UBOS). The scales were regularly tested and calibrated by a technical service firm accredited by UBOS. Height was measured to the nearest 0.1 cm using wooden measuring boards with fixed foot pieces and mobile headpieces, supplied by the Gulu District Health Office.

Nutritional status was classified using body mass index [BMI (kg/m^2)]. For adult participants >19 years, the following cut-off points were applied: underweight (BMI < 18.5), normal weight (18.5 ≤ BMI < 25), overweight (25 ≤ BMI < 30) and obese (BMI ≥ 30) [31]. For adolescents aged ≤19 years (≤228 months), BMI for age and BMI for sex *Z*-scores were generated using the WHO AnthroPlus software [32]. Undernutrition was defined as BMI for age and BMI for sex <5th percentile of the National Centre for Health Statistics (NCHS)/WHO reference population, and overweight as BMI for age and BMI for sex ≥2 standard deviations of the NCHS/WHO reference population [33].

Statistics

Pregnant women were excluded from analyses. Analyses were stratified by gender as it was thought that risk factors and associations differed between men and women. Data from the descriptive analyses were expressed in absolute and relative frequencies (for categorical variables) and median and interquartile range (for continuous variables not normally distributed). Pearson chi-square test (χ^2) was used to explore statistical differences between categorical variables and gender. Because the prevalence of obesity was very low, we combined overweight and obesity. We investigated factors associated with the observed prevalence of underweight using both univariate and multiple logistic regressions to calculate the odds ratios. Considering households as clusters, the generalised estimation equation (GEE) was incorporated in the multiple regression analyses, accounting for correlation within households. The structured correlation matrix was assumed to be 'exchangeable'; that is, within a household, all observations are equally distributed, but no correlation between observations from different households. The log link and binominal family functions were applied. All independent variables were first included in the multivariate model, with stepwise exclusion until all variables remaining were at significance level $P < 0.05$. Analyses were carried out with STATA version 11 (StataCorp. 2009. *Stata Statistical Software: Release 11*; StataCorp LP, College Station, TX, USA).

Ethics

Ethical approval was obtained from the Research and Ethics Committees of Gulu University, and the Uganda National Council for Science and Technology (UNCST), Study ref: SS 2363. All participants gave informed verbal and written consent after the purpose and content of the study was fully explained. Consent from caretakers was obtained for participants <18 years.

Results

Based on the Gulu HDSS census round 2 in 2012, there were 8137 people aged ≥15 years and eligible for the study. Of those, 5329 participated (51.3% of men and 79.6% of women). Reasons for not participating were as follows: field assistants not able to find a participant at home (39%); migrated out of the study area (29%); away at boarding school (10%); not known by local leaders (9%); death (9%); refusal (2%); in hospital (1%); and in prison (1%). Additionally, 295 pregnant women; 41 physically disabled people; three individuals <15 years of age; two drunken individuals; one dwarf; and one individual with errors in measurements were excluded. In total, 4986 people were included in the analyses (Figure 1). Participation was lower in younger age groups for both men and women. Median [25th, 75th percentile] age of participants was 31 [20, 44] for males and 34 [22, 49] for females, whereas median age of non-participants was 26 [18, 39] for males and 24 [18, 36] for females.

We found significant differences in sociodemographic and lifestyle characteristics between men and women. More women were divorced/separated (9.1%) and widowed (17.7%) than men (4.1% and 2.7%, respectively), $P < 0.001$. One of four women (24.5%) had never attended school *vs.* 2.4% of men; 47.1% of men had completed primary school or higher *vs.* 14.9% for women, $P < 0.001$. Smoking was more prevalent among men (32.0%) and virtually non-existent among women (0.5%), $P < 0.001$. The frequency of alcohol consumption was also higher among men than women: 83.4% of the women had never had an alcoholic drink, $P < 0.001$. Participant characteristics are shown in Table 1.

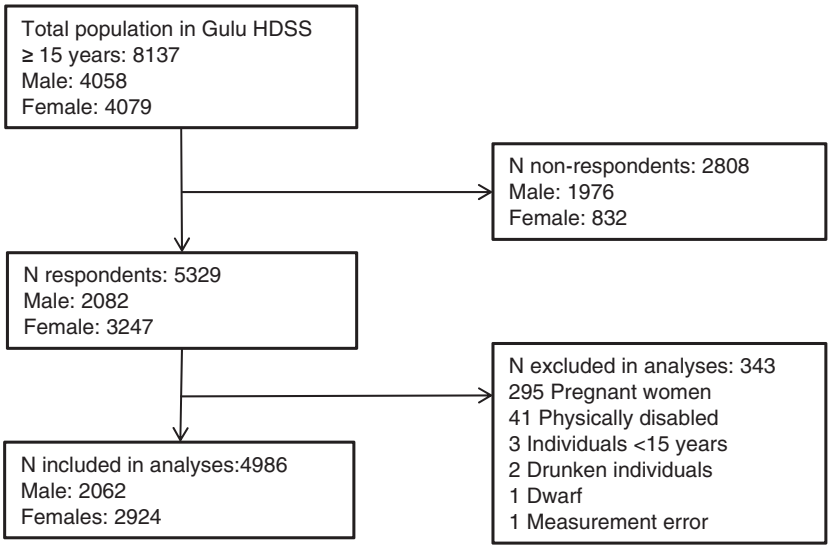

Figure 1 Flowchart

Table 2 shows the anthropometric characteristics of the study participants. The overall nutritional status differed between men and women. The prevalence of underweight was 22.3% in men and 16.0% in women ($P < 0.001$), while the prevalence of overweight (combined overweight and obesity) was 1.5% in men and 7.6% in women ($P < 0.001$).

Table 3 shows the risk factors for underweight by logistic regression analyses, presented for univariate and multivariate analyses for men and women. Only variables that were significantly associated with the outcome measure at the 10% level of significance from univariate analysis are included in the tables. For both men and women, age was associated with underweight. For women, both the crude and adjusted effect estimates suggest increased odds of being underweight with increasing age; elderly women ≥65 years were over six times more likely to be underweight (OR = 6.97, 95% CI: 4.54–10.71) than young women (15–19 years). Men aged 20–24 years had lower odds of being underweight, whereas men aged ≥55 years had greater odds of being underweight, odds were highest among men ≥65 years (OR = 3.34, 95% CI: 1.76–6.35) compared to young men (15–19 years). Thus, increasing age is a risk factor for both men and women, whereas young age (15–19) only appears as a risk factor for men.

Among men, being divorced/separated had greater odds of being underweight than being married/cohabiting (OR = 1.91, 95% CI: 1.21–2.99). For both men and women, the crude analyses indicated greater odds for being underweight for widows and lower odds for single/never married compared to married/cohabiting individuals. However, when adjusting for age, both associations tended towards null and were not significant.

Men who smoked daily were more than twice as likely to be underweight (OR = 2.17, 95% CI: 1.69–2.78) as non-smokers. In the crude analysis, for both men and women, effect estimates suggest increasing odds for being underweight with increasing frequency of alcohol intake. However, this association was not maintained in the adjusted model.

Lastly, women who had their nutritional status assessed during hungry-gap rainy season (May–July) were more likely to be underweight than women measured the rest of the year (OR = 1.33, 95% CI: 1.04–1.69). No association was observed between season and underweight among men. For men and women, we did not find education, occupation or food security to be risk factors for underweight.

Discussion

In this rural post-conflict population, we found marked gender and age differences in nutritional status; overall underweight was higher among men (22.3%) than women (16.0%), with elderly and young men being more likely to be underweight. Overweight was virtually non-existent in men (1.5%) and uncommon in women (7.6%).

The observed prevalence of underweight was higher than the national prevalence in rural areas reported by Demographic and Health Survey (DHS), Uganda (2011) (19.2% for men and 12.9% for women), whereas the prevalence of overweight was about half of the national

Table 1 Characteristics of study participants ($N = 4986$)

	Male *N* (%)	Female *N* (%)	*P*-value
N	2062	2924	
Age			
Median [p25, p75]	31 [20, 44]	34 [22, 49]	<0.001
15–19	470 (22.8)	518 (17.7)	
20–24	263 (12.8)	353 (12.1)	
25–34	437 (21.2)	644 (22.0)	
35–44	378 (18.3)	497 (17.0)	
45–54	227 (11.0)	394 (13.5)	
55–64	144 (7.0)	233 (8.0)	
≥65	143 (6.9)	285 (9.7)	
Marital status*			
Married/cohabiting	1347 (65.3)	1783 (61.0)	<0.001
Divorced/separated	85 (4.1)	266 (9.1)	
Widowed	55 (2.7)	519 (17.7)	
Single	575 (27.9)	356 (12.2)	
Education			
Never attended school	49 (2.4)	717 (24.5)	<0.001
Attended primary	1041 (50.5)	1772 (60.6)	
Completed primary (P7)	701 (34.0)	374 (12.8)	
Completed secondary (S4)	271 (13.1)	61 (2.1)	
Occupation			
Peasant farmer	1466 (71.1)	2557 (87.5)	<0.001
Employed or own business	211 (10.2)	89 (3.0)	
Student	367 (17.8)	239 (8.2)	
No occupation due to old age/disability	18 (0.9)	38 (1.3)	
Meals per day			
One meal	91 (4.4)	92 (3.2)	0.017
Two meals	1137 (55.1)	1619 (55.4)	
Three meals	810 (39.3)	1155 (39.5)	
Four meals or more	24 (1.2)	58 (2.0)	
Food security			
Poor	109 (5.3)	243 (8.3)	<0.001
Borderline	217 (10.5)	397 (13.6)	
Acceptable	1736 (84.2)	2284 (78.1)	
Household hunger score			
Severe hunger	0	1 (0.03)	0.041
Moderate hunger	59 (2.9)	121 (4.1)	
Little or no hunger	2003 (97.1)	2802 (95.8)	
Smoking daily			
No	1402 (68.0)	2908 (99.5)	<0.001
Yes	660 (32.0)	16 (0.5)	
Alcohol*			
Never had an alcoholic drink	1013 (49.2)	2439 (83.4)	<0.001
Less than once per month	110 (5.3)	148 (5.1)	
1–3 times per month	277 (13.4)	173 (5.9)	
1–4 days per week	529 (25.7)	131 (4.5)	
5–7 days per week	132 (6.4)	33 (1.1)	

Data expressed in number (%). *P*-values by chi-squared test across gender. Median [25th, 75th percentile] is provided for age (not normally distributed).
*One missing value in marital status and alcohol consumption.

rural prevalence (2.6% and 14.3%) [34]. In rural south-western Uganda, Maher *et al.* [35] found a higher prevalence of underweight among men (29.8%), a similar prevalence of underweight among women (16.5%) and a higher prevalence of overweight (4.1% for men and 17.4% for women). However, differences in BMI cut-off points and inclusion of study participants should be considered when comparing studies. The DHS and Maher *et al.* [34, 35] applied underweight cut-offs points for adults (BMI ≤ 18.5) on participants <19 years, which may overestimate the prevalence of underweight among young adults. The DHS only included women aged 15–49 years and men aged 15–54 years [34], which could have caused an underestimation of underweight. Maher *et al.* [35] included adults aged ≥13 years, which may explain the difference in the prevalence of underweight among men. Nevertheless, the studies report same trends with underweight being more prevalent among men and overweight more prevalent among women.

The observed gender difference among young adults is in line with previous studies in African settings [36–38]. The difference may be explained by pubertal growth spurt delay in young men compared to the reference group. This is common in populations where undernutrition is common [39, 40]. However, Kimani-Murage *et al.* [38] reported persistent gender differences after adjusting for pubertal stage. The difference may also be explained by behavioural, social and cultural factors, such as eating patterns and physical activity [36, 38, 41]. During the conflict in northern Uganda, abductions and traumatic experiences were more frequent among boys than girls [27]. This could put them in higher risk of poor mental health that may affect substance abuse and nutritional status. Our finding that men who smoked daily were twice as likely to be underweight as non-smokers was therefore unsurprising. The prevalence of daily smokers was high (31.6%) and almost twice as high than the prevalence in south-west Uganda [42].

The positive association between older age and underweight, for both men and women, is consistent with other studies in sub-Saharan Africa [43–45]. This is also in line with general physiologically decline in both weight and height with older age. In post-conflict areas with reverse urbanisation and withdrawal of food assistance, it can be difficult for the elderly to meet their basic needs [46]. Discrimination against elderly people in favour of children within households has been described in other sub-Saharan countries [45]. Consequences of underweight in the elderly include decline in immune response, functional and cognitive ability, decreased ability to contribute to household and economic activities, poor quality of life and mortality [47].

Table 2 Anthropometric characteristics (N = 4986)

	Male N (%)	Female N (%)	P-value
Weight median [p25, p75]	59.0 [54.0, 64.5]	54.0 [50.0, 60.0]	<0.001
Height median [p25, p75]	172.7 [168.0, 177.2]	162.3 [158.2, 166.7]	
Nutritional status by BMI			
Underweight	459 (22.3)	468 (16.0)	<0.001
Normal weight	1573 (76.3)	2235 (76.4)	
Overweight	30 (1.5)	298 (6.8)	
Obesity	0	23 (0.8)	
Nutrition status measured during hungry-gap rainy season			
No	1592 (77.2)	2318 (79.3)	0.174
Yes	470 (22.8)	606 (20.7)	

Data expressed in number (%). P-values by chi-squared test across gender. Median [25th, 75th percentile] is provided for weight and height (not normally distributed).

We found that being divorced or separated was a risk factor for underweight among men. Despite the high number of widowed women (17%), we did not find widowed or divorced/separated women to be at higher risk of underweight. This was unexpected. Female-headed households are seen as particularly vulnerable to food insecurity by humanitarian organisations [48, 49] and are included as target groups for food aid [50]. Although widowed women may not have rights to land ownership in the Acholi culture [18, 51], widowed and divorced women often receive support from relatives, which may prevent food insecurity. Disruption of social structures and altered gender roles during the conflict has previously been described to affect men more than women in northern Uganda. Dolan has described this with the concept 'the proliferation of small men in Northern Uganda', where women gained power within households, and where young men cannot fulfil social expectations and instead engage in alcohol abuse, violence, crime and suicide [52, 53]. In fact, during the conflict, women started producing alcohol for sale to men. Women also acquired power over food in the household when WFP implemented a policy to give food rations directly to the women [21, 53, 54]. Continued gender-related challenges when returning home from the camps include increased divorce and marital discord, alcohol abuse and domestic violence [55]. It has been suggested that marital quality is more important for women's mental health than it is for men's, while simply being married is more important to men's mental health. For example, being separated or divorced for a woman may be better for her mental health than remaining in a stressful marriage. However, it has not been explored whether this theory applies in the Acholi culture, and it has been challenged by other authors [56].

The observed gender and age disparities in nutritional status do not match with the continuously narrow focus on children <5 years and women in humanitarian assistance. The current WFP Nutrition Policy purely focuses on children <5 years, pregnant and lactating women and HIV- and tuberculosis-positive people as their target groups [57]. WFP's needs assessment tool only collects anthropometric measurements on children <5 years [49]. This position represents the focus taken by most humanitarian actors, where neither men, adolescents nor the elderly are considered a priority. Two recent reviews found that both gender research and healthcare financing in post-conflict states have been biased towards the health of women, specifically maternal and reproductive health [58, 59]. A few other studies have highlighted a mismatch between humanitarian target groups and groups who are actually vulnerable [12, 60, 61]. In Ethiopia, where special food aid programmes were implemented for female-headed households, Clay *et al.* [12] documented that female-headed households were no more food insecure than men-headed households. Adolescents and adults accounted for two-thirds of the mortality and acute malnutrition rates in the Somalia and Angola famine; yet, these groups were not taken into account in needs assessments [60].

We do not dismiss the importance of health and nutrition among children and women, especially in complex emergencies [1, 6, 7]. Still, we underscore the importance of assessing health and nutritional status among all population groups and to adjust global interventions to local settings. Failing to assess context-specific risk groups for malnutrition may lead to missed opportunities and unintended consequences. Underweight among adolescent men is a great concern, as young adults are a growing population group in developing countries, the future generation's workforce and providers for women and children. Furthermore, the older population in sub-Saharan Africa is projected to increase fourfold between 2005 and

Table 3 Risk factors associated with underweight by generalised estimation equation

	Men					Women				
		Univariate (N = 2062)		Multivariate (GEE) (N = 1649)			Univariate (N = 2924)		Multivariate (GEE) (N = 2308)	
	N underweight/ total (%)	OR	95% CI	OR*	95% CI	N underweight/ total (%)	OR	95% CI	OR*	95% CI
Age										
15–19	82/470 (17.5)	1		1		32/518 (6.2)	1		1	
20–24	20/263 (7.6)	0.39	0.23–0.65	0.36	0.20–0.67	50/353 (14.2)	2.51	1.57–4.00	2.47	1.56–3.92
25–34	67/437 (15.3)	0.86	0.60–1.21	0.73	0.41–1.29	94/644 (14.6)	2.60	1.71–3.95	2.55	1.68–3.86
35–44	97/378 (25.7)	1.63	1.17–2.28	1.25	0.69–2.24	85/497 (17.1)	3.13	2.04–4.80	3.07	2.03–4.64
45–54	70/227 (30.8)	2.11	1.46–3.05	1.55	0.83–2.88	70/394 (17.8)	3.28	2.11–5.10	3.25	2.08–5.07
55–64	57/144 (39.6)	3.10	2.05–4.67	2.48	1.30–4.73	46/233 (19.7)	3.74	2.31–6.05	3.69	2.31–5.90
≥65	66/143 (46.2)	4.06	2.70–6.09	3.34	1.76–6.35	91/285 (31.9)	7.12	4.61–11.02	6.97	4.54–10.71
$P > \chi^2$			<0.001		<0.001		<0.001		<0.001	
Marital status†										
Married/cohabiting	312/1347 (23.2)	1		1		282/1783 (15.8)	1			
Divorced/separated	31/85 (36.5)	1.90	1.20–3.01	1.91	1.21–2.99	35/266 (13.2)	0.81	0.55–1.18		
Widowed	22/55 (40.0)	2.22	1.27–3.85	1.25	0.69–2.27	131/519 (25.2)	1.80	1.42–2.27		
Single	94/575 (16.3)	0.65	0.50–0.84	1.26	0.75–2.11	20/356 (5.6)	0.32	0.20–0.51		
$P > \chi^2$			<0.001		0.036		<0.001			
Education										
Never attended school	20/49 (40.8)	1				156/717 (21.8)	1			
Attended primary	264/1041 (25.4)	0.49	0.27–0.89			245/1772 (13.8)	0.58	0.46–0.72		
Completed primary (P7)	129/701 (18.4)	0.33	0.18–0.60			57/374 (15.2)	0.65	0.46–0.90		
Completed secondary (S4)	56/271 (17.0)	0.30	0.15–0.57			10/61 (16.4)	0.71	0.35–1.42		
$P > \chi^2$			<0.001				<0.001			
Occupation										
Peasant farmer	347/1466 (23.7)	1				434/2557 (17.0)	1			
Employed or own business	47/211 (22.3)	0.92	0.65–1.31			9/89 (10.1)	0.55	0.27–1.10		
Student	58/367 (15.8)	0.61	0.45–0.82			15/239 (6.3)	0.33	0.19–0.56		
Old age or disability	7/18 (38.9)	2.05	0.70–5.33			10/38 (26.3)	1.75	0.84–3.62		
$P > \chi^2$			0.003				<0.001			
Food security										
Poor	23/109 (21.1)	1				50/243 (20.6)	1			
Borderline	50/217 (23.0)	1.12	0.64–1.96			63/397 (15.9)	0.73	0.48–1.10		
Acceptable	386/1736 (22.2)	1.07	0.67–1.72			355/2284 (15.5)	0.71	0.51–0.99		
$P > \chi^2$			0.922				0.143			
Smoking daily										
No	234/1402 (16.7)	1		1		462/2908 (15.9)	1			
Yes	225/660 (34.1)	2.58	2.09–3.20	2.13	1.67–2.73	6/16 (37.5)	3.18	1.15–8.78		
$P > \chi^2$			<0.001		<0.001		0.037			

Table 3 (*Continued*)

	Men					Women				
		Univariate (N = 2062)		Multivariate (GEE) (N = 1649)			Univariate (N = 2924)		Multivariate (GEE) (N = 2308)	
	N underweight/total (%)	OR	95% CI	OR*	95% CI	N underweight/total (%)	OR	95% CI	OR*	95% CI
Alcohol†										
Never had an alcoholic drink	174/1013 (17.2)	1				363/2439 (14.9)	1			
Less than once per month	17/110 (15.5)	0.88	0.51–1.52			29/148 (19.6)	1.39	0.91–2.12		
1–3 times per month	73/277 (26.4)	1.73	1.26–2.36			36/173 (20.8)	1.50	1.02–2.21		
1–4 days per month	148/529 (28.0)	1.87	1.46–1.41			28/131 (21.4)	1.55	1.01–2.40		
5–7 days per week	47/132 (35.6)	2.67	1.80–3.95			12/33 (36.4)	3.27	1.50–6.70		
$P > \chi^2$			<0.001				0.002			
Measured in hungry-gap rainy season										
No	348/1592 (21.9)	1				350/2318 (15.1)	1		1	
Yes	111/470 (23.6)	1.11	0.89–1.41			118/606 (19.5)	1.36	1.08–1.71	1.33	1.04–1.69
$P > \chi^2$			0.423				0.010		0.022	

*Adjusted for variables shown in table for multivariate analysis for male and female. $P > \chi^2$ for overall effect of variable by testparm. *n*(households) in GEE analyses. Only variables that reached significance at $P < 0.10$ in crude analysis are shown.
†One missing value in marital status and alcohol consumption.

2050, which will increase the burden of chronic disease on healthcare services [62]. The fact that the national DHS does not collect data on women >49 years and men >54 years means that the Ugandan Ministry of Health is unaware of this population's health needs and cannot plan health care accordingly.

In the present study, women who had their nutritional status assessed during hungry-gap rainy season (May–July) were more likely to be underweight than women measured during the rest of the year. Nielsen *et al.* [63] also found seasonal variation in child malnutrition during conflict in Sudan with higher malnutrition and mortality in hungry-gap rainy season. However, humanitarian food interventions were not adjusted to seasonal variations neither in Sudan [63] nor in northern Uganda. Future programmes in conflict and post-conflict areas should consider local seasonal variation.

Strengths and limitations

One of the main strengths of the study is the community-based approach, with inclusion of all adult age groups and all geographical areas within Gulu HDSS. However, we had a higher participation rate among women than men. Participation was lower among the younger population, especially among women, which was partly due to the exclusion of pregnant women. The study population is very mobile, with frequent change of residence and multiple homes, especially among men. However, it is not likely that this would affect our findings on gender differences in nutritional status. In any case, we would expect greater difference by increased prevalence of underweight among men, as young men were more likely to be underweight. Our study design was cross-sectional, and causality cannot be inferred. It is possible that unmeasured confounders can confuse the association between risk factors and underweight. Potential unmeasured confounders could be mental health, HIV/AIDS, tuberculosis or other diseases. The estimated HIV prevalence in 2011 for northern Uganda was 10.1% among women and 6.3% among men [64]. Tuberculosis and other chest infections are also a potential unmeasured mediating factor in the association between smoking and underweight. As both HIV and tuberculosis are highly stigmatised in northern Uganda, it was not possible to obtain reliable information on these with a community-based study design. Residual confounding on other variables as the WFP score for food security and alcohol may also explain why we did not find any association. Despite extensive training efforts, we cannot eliminate information bias and recall bias.

Conclusions

Identified risk factors and groups for adult undernutrition are not presently in focus in humanitarian assistance. Focussing on conventional target groups in food aid policies may contribute to disruption of existing family and social structures, and thereby create other risk groups that are not targeted.

Acknowledgements

We are very grateful to all the residents of Awach subcounty for their willingness to participate in the survey and to the Gulu HDSS Field Assistants for their determined hard work. We acknowledge Mr. Ceaser Okumu Law for supervising the data management, and the ENRECA project team at Gulu University. We also thank the Gulu District Health Office for their overall support with the study. The work was supported by the Lundbeck Foundation, the ENRECA Gulu Project, the Danida Fellowship Centre and the Centre for Global Health, University of Southern Denmark.

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