

Food Security and Nutritional Status of Children Residing in Sugarcane Growing Communities of East-Central Uganda: A Cross-sectional Study

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Abstract Undernourishment is a major public health issue in several developing countries including Uganda. Sugarcane farming practiced in several districts of the East-central Uganda is reported to be threatening food and nutrition security. We assessed household food and nutrition security in order to inform nutrition policy and program design for communities engaged in cash crop production. We conducted a cross-sectional study in Jinja district east-central Uganda. All households with children aged below five years in Nabitambala parish Busede sub-county were investigated. A total of 646 children from 382 households were studied. Food security data were collected using the Household Food Insecurity Access Scale. Nutritional status of the children was assessed using Height-for-Age, Weight-for-Age and Weight-for-Height to measure stunting, underweight and wasting respectively. Standard deviation (SD) scores (Z-scores) were applied to determine nutritional status. Statistical analysis was done using STATA statistical software package. The prevalence of stunting, underweight and wasting was 33.3%, 27.4% and 18% respectively. Of the 382 households studied 12% were food secure while 14.7%, 23.6% and 49.7% had mild, moderate and severe food insecurity respectively. Of the 95 households with wasted underweight and stunted children, the majority (85.3%, 88.3% and 91%), were food insecure respectively. The percentage of households with children who were malnourished significantly increased with increase in the number of children in the households. There is high prevalence of malnutrition and household food insecurity in the sugarcane growing communities of east-central Uganda. Short and long term measures are required to mitigate food insecurity and malnutrition in these settings especially in households with many children.

Keywords: food security, malnutrition, stunting, underweight, wasting, children, sugarcane growing, Uganda

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1. Introduction

Despite the general global reduction in food insecurity, malnutrition remains a public health challenge in several developing countries including Uganda. By 2013, a total of 222.7 million (24.8%) people were estimated to be undernourished in Sub-Saharan Africa compared to 15.7 million (<5%) people in the developed regions [1]. The relationship between food insecurity and malnutrition is widely documented [2,3,4]. Currently, an estimated 18%, 39% and 7% of the children aged below 5 years are underweight, stunted and wasted respectively in Eastern and Southern Africa [5]. In Uganda, 33%, 14% and 5% of children aged below 5 years are stunted, underweight and wasted respectively [6].

In spite of the diverse nutrition interventions that have existed for decades, progress on reduction of malnutrition

remains slow. The global proportion of children, who are stunted for example, fell from 40% in 1990 to 27% in 2010 translating into an overall reduction of 13% in 20 years and an average reduction rate of 0.6% per year. Africa registered a much slower reduction, ranging from 40.3% in 1990 to 38.2% in 2010 registering an overall reduction of only 2% in 20 years [7]. Progress on undernourishment in Uganda has been similarly slow [1]. Uganda reduced the level of stunting, underweight and wasting among children aged below five years from 38%, 16% and 6% in 2001 to 33%, 14% and 5% in 2011 respectively [6,8].

The causes of malnutrition are widely known. However, the progress towards solving the problem of malnutrition in the midst of tested and proven interventions remains slow. Some activities performed in the context of economic development act as drivers for malnutrition. For example, thousands of hectares of fertile land have been turned into cash crop growing; a practice that has left

many families food insecure. One major cash crop that has been implicated is sugarcane [9]. In Swaziland for example, the Komati Downstream Development Project (KDDP) turned most of the fertile land into sugarcane growing at the expense of food crops production [10]. This has resulted into food insecurity within the affected communities.

In Uganda, sugarcane farming is practiced in many districts of the East-central region and is reported to be threatening food and nutrition security [11,12]. Available data indicates that 39.4%, 21.7% and 7.1% of children in this region are stunted, underweight and wasted respectively [6]. These figures are higher than the overall national figures of Uganda.

According to Food and Agricultural Organization (FAO), food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life [13]. Economic access to food is determined by the availability of disposable income which may be generated from sale of the cash crops [1]. Thus, through sugarcane production, households could generate income to purchase food and create a state of food security that would reduce malnutrition.

Malnutrition is caused by a web of factors that commonly interact at different levels of the human lifecycle. The immediate causes of malnutrition include inadequate dietary intake and infectious diseases each of which potentially interact to create a vicious cycle. According to UNICEF, there are three clusters of underlying causes that lead to inadequate dietary intake and infectious diseases including 1) Inadequate access to food in a household as a result of food insecurity, 2) Inadequate care for children and women and 3) Insufficient health services and an unhealthy environment [14]. These underlying factors as well as poverty are common in Uganda, including the sugarcane growing communities [15].

The magnitude of malnutrition and food insecurity in the sugarcane growing communities of East-central Uganda is not well documented. Our study aimed at analyzing and describing the food and nutrition security situation in these communities in order to inform nutrition policy and program design for communities engaged in cash crop production.

2. Materials and Methods

2.1. Design and Sampling Procedure

We conducted a cross-sectional study in Nabitambala parish, Busede sub-county in Jinja district. Busede sub-county was purposively selected because of its longstanding involvement in sugarcane growing. Within Busede, Nabitambala parish with 9 villages was randomly selected. All households with children aged below five years in the selected parish were investigated. Within the households, all children aged below five years were included in the study, with the exception of those who were mentally or physically disabled. Overall, we enrolled 646 children from the 382 households within the parish.

2.2. Data Collection Procedure

2.2.1. Anthropometric Measurements

Anthropometric measurements including height and weight were undertaken using Gibson's guidelines [16].

Weight measurement

Children were weighed using Salter and Seca scales. The scales were validated with standard weights before the measurements. The scales were either hanged or placed on a hard flat surface. Children were weighed while naked. Each child was measured twice and the two measurements compared, with a level of agreement within 10 g. For cases where the difference between the measures exceeded the tolerance limit of 10g, the child was repositioned and measured for a third time. The average of the two measures in closest agreement was then recorded.

Height/length measurement

Length or height measurements were taken using a height board. Children either lay or stood on the measuring board with their back, heels, buttocks and shoulders in contact with the board. Their legs were placed together with the knees and ankles touching each other. The headpiece was then brought down onto the upper most point of the head and the height recorded to the nearest 0.1 cm at the examiner's eye level. Children aged below two years or those who could not stand were measured while lying down.

2.2.2. Food Security Measurement

Data were collected using the Household Food Insecurity Access Scale (HFIAS) tool approved by Food and Agricultural Organization (FAO) [17]. The tool has nine generic questions across the three domains of anxiety and uncertainty for food supply, insufficient food quality and insufficient food intake. This tool is presented in Table 1.

Food security was defined using FANTA III and USAID indicator guide [17]. Each question within the questionnaire had a 'Yes' and 'No' option. If the respondent answered 'No' to the question, the household score was '0'. The 'Yes' option had three alternatives; 1) rarely, scoring 1; 2) sometimes, scoring 2; and 3) often, with a score of 3. If the household response to all the nine questions was 'often', the maximum score for a household was 27 and a minimum of 0 if the respondent answered 'No' to all the questions. The higher the score, the more food insecure (inability to access food) was the household and the lower the score, the less food insecurity a household experienced. Households were graded as food secure, mildly, moderately, and severely food insecure basing on the responses.

2.3. Data analysis

The nutrition status of children was assessed using weight-for-age, weight-for-height and Height-for-age which represented underweight, wasting and stunting respectively. Standard deviation (SD) scores (Z scores) were applied to determine the nutritional status as recommended by WHO [18]. Children with weight-for-age, weight-for-height and Height-for-age of equal or above -2SD scores were considered underweight, wasted or stunted on the respective Z-score scales. Children scoring -3SD and below were categorized as severely malnourished under the three parameters.

Data were entered in a validated entry screen designed in Epi-Info 2007. The data were later exported to STATA

(Ver. 12.0) for cleaning and analysis using zanthro extensions which generates the standardized anthropometric measures for children with reference to the WHO child growth standards [19].

Data were analyzed using STATA (Ver. 12.0). We performed descriptive analysis and bivariate analysis to investigate the association between food insecurity and malnutrition.

Table 1. Household Food Insecurity Access Scale (HFIAS) Tool

Domain	Question
Anxiety and uncertainty for food supply	1. Did you worry that your household would not have enough food? Yes/No 1.a If Yes: 1) Rarely; 2) Sometimes; 3) Often
Insufficient Food Quality	2. Were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources? Yes/No. 2.a If Yes: 1) Rarely; 2) Sometimes; 3) Often 3. Did you or any household member have to eat a limited variety of foods due to a lack of resources? Yes/No. 3.a If yes: 1) Rarely; 2) Sometimes; 3) Often
	4. Did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food? Yes/No. 4.a If yes: 1) Rarely; 2) Sometimes; 3) Often
Insufficient food intake	5. Did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food? Yes/No. 5.a If yes: 1) Rarely; 2) Sometimes; 3) Often 6. Did you or any household member have to eat fewer meals in a day because there was not enough food? Yes/No. 6.a If yes: 1) Rarely; 2) Sometimes; 3) Often 7. Was there ever no food to eat of any kind in your household because of a lack of resources to get food? Yes/No. 7.a If yes: 1) Rarely; 2) Sometimes; 3) Often 8. Did you or any household member go to sleep at night hungry because there was not enough food? Yes/No. 8.a If yes: 1) Rarely; 2) Sometimes; 3) Often 9. Did you or any household member go a whole day and night without eating anything because there was not enough food? Yes/No. 9.a If yes: 1) Rarely; 2) Sometimes; 3) Often

2.4. Ethical Approval

This study was part of a bigger project of a positive deviance hearth project implemented in Jinja District East-central Uganda. The paper is based on the baseline (pre-implementation) data. The project was approved by the Makerere University School of Public Health (MakSPH) Institution Review Board (IRB) and the Uganda National Council for Science and Technology (UNCST). All children identified with severe malnutrition were referred to a nearby health facility or nutrition unit for management.

3. Results

3.1. Food Security

Approximately 50.0% of the households assessed were severely food insecure as shown in Table 3. Only 12.0% of the households were food secure as seen in Table 2 below.

Table 2. Household Food Security

Household food security status	(f)	(%)
Food secure	46	12.0
Mildly Food Insecure	56	14.7
Moderately food insecure	90	23.6
Severely food insecure	190	49.7
Total	382	100

3.2. Nutritional Status of Children

A total of 646 children aged below five years from 382 households were assessed to ascertain their nutrition status. Approximately 50.0% of the children were males and 54.4% were aged above two years (Table 3). Results in Table 4 also show that, 33.3%, 18% and 27.4% of the children were stunted, wasted and underweight respectively. The results also reveal that 14.8%, 7.9% and 9.8% of the children were severely stunted, wasted and underweight respectively. The percentage of households with children who were malnourished increased with increase in the number of under-five year old children within the households (Table 4).

Table 3. Child Nutritional Status as measured by Height-for-Age, Weight-for-Height and Weight-for-Age

Background Characteristic	Nutritional Status								
	Height-for-Age			Weight-for-Height			Weight-for-Age		
	< -3 SD n(%)	≥-3<-2 SD n(%)	≥-2 SD n(%)	< -3 SD n(%)	≥-3<-2 SD n(%)	≥-2 SD n(%)	< -3 SD n(%)	≥-3<-2 SD n(%)	≥-2 SD n(%)
Sex									
Female	39 (6)	64(10)	218 (32)	20(3)	34(5)	267(41)	29(5)	56(9)	236(37)
Male	57(9)	56(9)	212 (33)	31(5)	31(5)	263(41)	34(5)	58(9)	233(36)
Age (Months)									
0-12	11(2)	15(2)	120(19)	20(3)	19(3)	107(17)	10(2)	28(4)	108(17)
13-24	28(4)	33(5)	88(14)	6(1)	18(3)	125(19)	15(2)	29(5)	105(16)
25 & above	57(9)	72(11)	222(35)	25(4)	28(4)	298(46)	38(6)	57(9)	256(40)
# of children in household									
1	20(3.0)	37(6)	151(24)	13(2)	26(4)	169(26)	17(3)	30(5)	161(3)
2-3	70(10.8)	75(11.2)	249(39)	33(5)	33(5)	328(51)	40(6)	74(12)	280(43)
4 & above	6(1.0)	8(1)	30(5)	5(1)	6(1)	33(5)	6(1)	10(2)	28(4)

Table 4. Malnutrition and household child population

Household (HH) nutritional status	Number of under-five year old children in a household			Total n(%)	P Value
	Only one n(%)	Two to three n(%)	Four or more n(%)		
Wasting					
HH with a wasted child	35(17.6)	51(29.3)	9(81.8)	95(24.7)	<0.001
HH without a wasted child	164(82.4)	123(70.7)	2(18.2)	289(75.3)	
Underweight					
HH with an underweight child	45(22.6)	84(48.3)	9(81.8)	138(35.9)	<0.001
HH without an underweight child	154(77.4)	90(51.7)	2(18.2)	246(64.1)	
Stunting					
HH with a stunted child	55(27.6)	105(60.3)	8(72.7)	168(43.8)	<0.001
HH without a stunted child	144(72.4)	69(39.7)	3(27.3)	216(56.3)	

3.3. Household Food Security and Child Nutritional Status

The percentage of households with wasted children was slightly lower (27%) among households with severe food insecurity compared to 30% among those which were food secure. Of the households containing wasted, underweight

and stunted children, majority (85.3%, 88.3% and 91%) were classified as being food insecure compared to only 14.7%, 11.7% and 9.0% of households which were food secure respectively. Overall, 73%, 63% and 54% of the households classified with severe food insecurity had no wasted, underweight and stunted children respectively (Table 5).

Table 5. Household food security and child nutritional status

Household (HH) nutritional status	HH Food Security								Total Column (%)	Row %	P Value
	Food secure		Mildly Food Insecure		Moderately food insecure		Severely food insecure				
	Column n(%)	Row %	Column n(%)	Row %	Column n(%)	Row %	Column n(%)	Row %			
Wasting											
HH with a wasted child	14(30.0)	14.7	11(20.0)	11.6	19(21.0)	20.0	51(27.0)	53.7	95(25.0)	100	0.448
HH without a wasted child	32(70.0)	11.2	45(80.0)	15.7	71(79.0)	24.7	139(73.0)	48.4	287(75.0)	100	
Underweight											
HH with an underweight child	16(35.0)	11.7	20(36.0)	14.6	30(33.0)	21.9	71(37.0)	51.8	137(36.0)	100	0.927
HH without an underweight child	30(65.0)	12.2	36(64.0)	14.7	60(67.0)	24.5	119(63.0)	48.6	245(64.0)	100	
Stunting											
HH with stunted child	15(33.0)	9.0	23(41.0)	13.8	42(47.0)	25.1	87(46.0)	52.1	167(44.0)	100	0.374
HH without stunted child	31(67.0)	14.4	33(59.0)	15.3	48(53.0)	22.3	103(54.0)	48.0	215(56.0)	100	

4. Discussion

This study assessed the magnitude of household food insecurity and nutritional status among under-five children in sugar cane growing communities of Jinja district east central Uganda. We found that a half of the households assessed had severe food insecurity and only 12% were food secure. Approximately 2 out of every ten children (18%) had acute malnutrition, a third had stunted growth and more than a quarter (27.4%) was underweight. An estimated 8%, 10% and 15% of the children were found to be severely wasted, underweight and stunted respectively.

According to the WHO classification of community malnutrition for public health decisions, the prevalence of stunting and underweight observed in our study is considered high while the prevalence of wasting had reached a critical level [19]. The prevalence of stunting in this study is similar to the 33% reported in the 2011 Uganda Demographic and Health Survey (UDHS). However, the prevalence of underweight was almost twice Uganda's national figure with wasting being more than three times higher than the national prevalence and more than twice that of the East-central region [6]. The level of underweight was however, not very different from that of

the East-central regional figure of 21.7%. These findings highlight the unique nature of this region regarding child nutrition suggesting a need for special attention to these sugarcane growing communities in terms of prevention and management of acute malnutrition.

The high prevalence of underweight and wasting detected in our study has been reported in other developing countries. A recent Demographic and Health Survey in Nigeria reported a prevalence of 18% and 29% for wasting and underweight respectively [20]. In a related survey, Ethiopia reported an underweight and wasting prevalence of 29% and 10% respectively [21]. Increasing cases of acute malnutrition in comparison to cases of stunted growth raise concerns in terms of acute deprivation of food in resource limited settings. High wasting and low stunting patterns have been attributed to acute food shortages among pastoralists in Kenya, Ethiopia and Somalia [22]. This observation was attributed to acute shortages of food. Our findings also suggest that chronic deprivation of food is not as critical as acute deprivation in these sugarcane growing communities which is not surprising considering that a half of the households were severely food insecure. This calls for interventions geared at addressing acute food shortages in sugarcane growing communities.

Sugarcane producing communities are expected to generate enough income from sale of the cash crop which could be used to increase their purchasing power for foodstuffs. It is however, surprising that the money generated from the cash crop is not transformed into food. We found that out of the 95 households having wasted, underweight and stunted children, the majority (85.3%, 88.3% and 91%) were generally food insecure. This observation is an indication that food insecurity may be one of the major drivers for the cases of acute malnutrition in these communities. Studies done in Colombian, Nigeria, Tanzania and Nepal have shown an association between food insecurity and malnutrition [2,3,4,23]. Programs formulated to improve household food security may play a major role in reduction of child malnutrition in these settings. In Asia for example, a homestead food production model was able to improve both food security and nutritional status of women and their children [24].

Our findings also show a somewhat similar percentage of wasted children among households with severe food insecurity (30%) and among those which were food secure (27%) suggesting the contribution of other factors.. Further research is needed to ascertain other underlying factors, to inform more comprehensive interventions.

We observed that the percentage of households with children who were malnourished increased with increase in the numbers of under-five years old children within the households. Under five child malnutrition has been associated with larger numbers of children and higher fertility among poor households [25,26,27,28]. With a fertility rate of 6.9 and only 32% of women in the East-central region of Uganda using any method of family planning, increasing uptake of family planning services is required to further mitigate the problem of malnutrition among children [6].

It was surprising to note that 73%, 63% and 54% of the households classified with severe food insecurity had no wasted, underweight and stunted children respectively. These findings support the Positive Deviance (PD) Hearth model which is an adaptive response for satisfactory child growth under harsh economic circumstances such as food scarcity. The model presupposes that even in the poorest communities, some mothers are still able to raise healthy and well-nourished children a situation that has been observed in our study [29,30]. Such resilient sugarcane growing households may provide lessons for those with malnourished children, in line with the positive deviance model and may play a major role in reducing malnutrition using limited resources.

5. Limitations

Our study had limitations. We did not have a control (non-sugarcane growing) community and did not assess other potential factors like disease trends as well as the socio-economic conditions which are likely to play a major role in children's health and nutrition. Additionally, the study did not document the positive practices among households that were food insecure but with well nourished children; areas that may require further research. Our results are however important in terms of highlighting the major problem of severe food insecurity and malnutrition among these sugarcane producing communities.

6. Conclusion

There is high prevalence of malnutrition and household food insecurity in the sugarcane growing communities in Jinja district, east-central Uganda. There is need for key stakeholders to put in place both short and long term measures, including nutrition interventions as well as policies to address the problems of malnutrition and food insecurity in these settings.

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Statement of Competing Interests

The authors declare no competing interests.

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