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ABSTRACT

Objectives: **To estimate the prevalence of reported food insufficiency associated socio-demographic factors and health indicators in rural Tanzania.**
Design: **A cross-sectional study.**
Setting: **A rural community in Kilimanjaro, Tanzania.**
Subjects: **Eight hundred and ninety nine individuals aged 15-36 years. A structured questionnaire was administered to collect information on socio-demographic factors, health indicators and food insufficiency. Participants were tested for HIV-1 using saliva samples.**
Results: **The prevalence of food insufficiency was 25.3% with no sex difference. After controlling for potential confounders age (Adjusted Odds Ratio [AOR] = 1.05; 95% Confidence Interval [CI]: 1.02-1.08), low education level (AOR = 4.73; CI: 1.30-17.11), being a peasant (AOR = 2.29; CI: 1.04-5.04), poor self-rated health status (AOR = 4.35; CI: 1.71-11.00) and having health problems (AOR = 2.23; CI: 1.21-4.08) were associated with food insufficiency among women but not men. In unadjusted analysis, women with food insufficiency had over twice the odds of testing HIV positive although the association did not reach statistical significance (AOR = 2.12; CI: 0.87-5.19) in adjusted analysis.**
Conclusions: **Food insufficiency was prevalent in rural Tanzania. It was associated with socio-demographic factors and health indicators among women but not men. Our findings suggest that food insufficiency may play a role in increasing vulnerability to HIV infection particularly among women however; more research is needed to explore further this relationship.**

INTRODUCTION

Food security is defined by the World Food Summit (WFS) as a state where "all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life (1)." Food insufficiency and food insecurity are commonly perceived to be the same and often used interchangeably. Where as food insufficiency refers to the inadequacy in the amount of food intake due to lack of money or resources, food insecurity is broader including food insufficiency, qualitative and psychosocial aspects of food intake and supply. In this paper they are used interchangeably.

In spite of the fact that many countries report of sufficient food supply at the national level food insecurity at the household and individual level is still

a problem. The United Nations Food and Agriculture Organisation (FAO) estimates that about 852 million people are undernourished globally, of which 815 million of these are in developing countries and around 200 million live in sub-Saharan Africa (2).

Compared to developed countries (3,4) the prevalence of food insecurity in developing countries (5-8) is high and varies with geographical location and cause (9). The primary cause of food insecurity is poverty as has been illustrated by the associations observed between food insecurity and indicators of poverty such as low income, low education levels and unemployment (3-8). Despite the magnitude of this phenomenon in developing countries and development of self report assessment tools that are relatively affordable, little in terms of research addressing food insecurity has been performed in developing countries and in particular Africa. Furthermore, the majority of these studies have included women and children as their main sample. Studies including men are scarce and thus limited information is available on the role of men in food insecurity (4,10,11).

The purpose of this study was to use a self report measure to assess the prevalence of food insufficiency and identify socio-demographic factors and health indicators associated with food insufficiency among men and women in rural Tanzania.

MATERIALS AND METHODS

Study area: The study was conducted in Oria village, Kahe Ward in the Kilimanjaro region. The village is located 30km south of Moshi (the regional administrative capital) and had a population of about 3,873 (12). The majority of the population were engaged in small scale farming activities while a smaller proportion were involved in petty business or employed. The village had a weekly market selling a wide variety of commodities ranging from fruit and vegetables to clothes and shoes. A more detailed description of the area has been described elsewhere (12).

Study population and sampling: The 'Kahe' study was a cross-sectional survey that included participants between the ages of 15-36 years residing in the village. All individuals in the specified age group with a permanent address in the village were eligible for participation.

Procedure and ethical consideration: The study was conducted in the dry post-harvest season between June and August 1997. All eligible subjects were identified through house to house registration and interviews were conducted using a pre-tested questionnaire administered by a team of trained research assistants within the household premises. Information on socio-demographic factors, food insufficiency and health indicators was collected using a revised version of previously used questionnaire. Saliva samples for HIV testing were collected by trained personnel within the participant's household compound. All eligible subjects absent after two consecutive follow-up visits were excluded from the study.

The survey was reviewed and cleared by the Tanzanian Ethical Committee of the Ministry of Health and by the Norwegian Committee for Medical Research Ethics. The study was introduced through meetings at various levels of the district administration and village. All participants provided verbal informed consent prior to inclusion in the study. Pre-test counselling was provided before HIV testing and post-test counselling to all who came back to receive their results. Individual health education was provided to all participants to correct any misconceptions concerning HIV / AIDS.

Measurement of food insufficiency: Food insufficiency status was determined by the question: "which of the following statements best describes the amount of food eaten in your household: (i) have enough to eat; (ii) sometimes have enough food to eat; (iii) often do not have enough to eat." The second and third options were defined as food insufficient for the purpose of this paper. This definition has been interpreted as a proxy for "food insecurity" (16), is consistent with other studies and provides valid and reliable data (3,4,13-15).

Socio-demographic variables and health indicators: Socio-demographic factors included in the analysis were age (continuous), number of children (continuous), sex (male, female), marital status (single, married / cohabiting, previously married including separated, divorced and widowed), religion (Christian, Moslem), education (no formal education, primary, secondary or higher), occupation (peasant, employee, petty business, student), and ethnicity which was condensed into six categories (Pare, Chagga, Kahe,

Kamba, Zigua, others). Self-reported health status was assessed using a self-rated health scale and was operationalised as "in general how healthy would you say that you are compared to other people of your own age?" The response was scaled into one of three categories very healthy, healthy or not healthy. In the analysis the three categories were dichotomised into healthy / not healthy. A follow-up question concerning health problems during that period was posed and assessed as yes or no. HIV status was categorised as negative or positive.

HIV-1 testing: HIV-1 screening was conducted using saliva samples collected by Omni-Sal saliva collection devices (Saliva Diagnostic Systems; Vancouver, WA). Saliva testing is cost efficient, sample collection is non-invasive and specimens are safer to handle than blood. Antibodies to HIV can be detected in saliva with sensitivities of 97.2-100% and specificities of 97.7-100% equivalent to those obtained with serum based assays (17).

Testing was performed by using two independent recombinant enzyme-linked immunosorbent assays (EIA); Bionor HIV 1&2 EIA (Bionor AS; Skien, Norway) and Vironostika HIV-1 Uniform II EIA (bioMérieux; Durham, NC). All discordant or doubtful EIA results were confirmed using OraSure Western Blot (OraSure Technologies; Inc.; Bethlehem, PA).

Statistical analysis: Data analyses were performed using Statistical Package for Social Sciences SPSS 12.0 (Chicago, IL. USA). Descriptive characteristics of the variables were assessed by means or frequencies. Inter-informant agreement and kappa of responses to the food insufficiency question was calculated to assess reliability. Two individuals (the person most responsible for food provision included) from the same family (n = 173) were included in the analysis. Contingency tables for chi square statistics were performed to examine between group differences in socio-demographic characteristics by food insufficiency status. The Student t-test was used to assess differences between means. Logistic regression models unadjusted and adjusted for age, education and ethnicity were run and reported as odds ratios (OR) with 95% confidence intervals (CI). All models were stratified by sex. The significance level was taken at $p<0.05$.

RESULTS

Sample characteristics: A total of 899 individuals agreed to participate in the study giving a participation proportion of 79.1% (899/1 136). All individuals with missing information on age (n = 6), sex (n = 1) and food insufficiency (n = 2) were excluded from the analysis. The final population sample consisted of 488 *(54.8%)* women and 402 men. The mean age of survey respondents was 23.4 years (24.2 women vs. 22.5 men; $p<0.001$). One half of the sample was single and 46% married or cohabiting. Eighty-four percent of the participants reported to have children with an average of three children per respondent. The primary economic activity in this rural population was farming (60%). Majority of the sample had primary education (74%) and 20% had no formal education while only 7% had secondary education and above. Approximately fifty percent of the respondents were Christians and the main ethnic groups were Pare (40%) and Chagga (24%).

Food insufficiency: The overall prevalence of self reported food insufficiency was 25.3% (95% CI: 22.4%, 28.2%). There was no difference in the distribution of food insufficiency between males and females (22.9% vs. 27.3%; $p = 0.14$). Reliability analysis revealed, food insufficiency reported by the first informant was significantly related to the second informant ($\chi^2 = 18.2$, $p<0.05$). The percent agreement between the two informants was 75.2% (130/173; kappa = 0.32).

As shown in Table 1, food insufficiency was associated with age, occupation, education, marital status, ethnicity and having children. The difference in the number of children reported by food insufficient and food sufficient respondents had marginal significance.

In the female strata, women who reported food insufficiency were characterised by being older, having children, no formal education, being peasants and of the Pare or Zigua ethnic groups (Table 2).

In the male strata, no associations were observed between food insufficiency and any of the selected socio-demographic factors (Table 3).

Health indicators: Few participants (4%) perceived their health to be poor and 11% reported a health problem. Women who rated their health as not healthy were over four times more likely to report food insufficiency than those who rated their health more positively. Those who had a health problem were twice as likely to report food insufficiency as those who did not have a health problem (Table 4).

The overall prevalence of HIV-1 in this study population was 4.3%. Women who reported food insufficiency had over twice the odds of testing HIV positive (Table 4), although the association did not remain statistically significant after adjusting for age, education and ethnicity.

Table 1

Sample characteristics by food insecurity status in the Kahe Study, Kilimanjaro

Variable	Category	No.	Percent of		P-value
			Food sufficient	Food insufficient	
Age (years)	Mean ± SD[1]	890	22.9 ± 7.1	25.1 ± 7.2	0.000
Number of children	Mean ± SD	433	2.7 ± 1.7	3.1 ± 1.9	0.055
Children present	No	459	81.1	18.9	
	Yes	431	68.0	32.0	0.000
Sex	Female	488	72.7	27.3	
	Male	402	77.1	22.9	0.136
Occupation	Peasant	509	70.5	29.5	
	Employee	35	100	0	
	Petty business	103	71.8	28.2	
	Student	226	81.9	18.1	0.000
Education	No formal education	170	67.1	32.9	
	Primary education	646	75.9	24.1	
	Secondary education +	59	83.1	16.9	0.02
Marital status	Single	389	79.2	20.8	
	Married / cohabiting	363	70.8	29.2	
	Previously married	43	65.1	34.9	0.011
Ethnicity	Kamba	41	92.7	7.3	
	Pare	359	68.3	31.7	
	Chagga	211	78.2	21.8	
	Kahe	57	77.2	22.8	
	Zigua	34	64.7	35.3	
	Others	188	80.3	19.7	0.001
Religion	Christian	453	77.1	22.9	
	Moslem	412	71.6	28.4	0.067

[1] = Standard Deviation

Table 2

Crude and adjusted odds ratio of food insufficiency for women by socio-demographic characteristics in the Kahe study, Kilimanjaro

Variable	Category	Percent of		Odds ratio		
		Food sufficient (n = 355)	Food insufficient (n = 133)	Crude	Adjusted[2]	95% CI
Age (years)	Mean ± SD[1]	23.5 ± 7.2	26.3 ± 7.2	1.06	1.05	1.02 - 1.08
Number of children	Mean ± SD	3.0 ± 1.7	3.3 ± 2.1	1.08	1.04	0.86 - 1.25
Children present	No	83.4	16.6	1.0	1.0	
	Yes	66.4	33.6	2.54	2.40	1.24 - 4.62
Occupation	Peasant	68.0	32.0	2.51	2.29	1.04 - 5.04
	Employee	100	0	-	-	NS
	Petty business	70.4	29.6	2.25	2.29	0.95 - 5.52
	Student	84.3	15.7	1.0	1.0	
Education	No formal education	57.4	42.6	4.94	4.68	1.29 - 16.97
	Primary education	76.1	23.9	2.09	2.26	0.64 - 7.87
	Secondary education +	87.0	13.0	1.0	1.0	
Marital status	Single	79.7	20.3	1.0	1.0	
	Married / cohabiting	67.9	32.1	1.85	1.35	0.75 - 2.42
	Previously married	68.4	31.6	1.81	1.05	0.43 - 2.56
Ethnicity	Kamba	90.9	9.1	1.0	1.0	
	Pare	65.5	34.5	5.27	6.12	1.32 - 28.25
	Chagga	77.2	22.8	2.95	3.68	0.76 - 17.61
	Kahe	69.0	31.0	4.50	3.79	0.69 - 20.73
	Zigua	58.8	41.2	7.00	8.63	1.42 - 52.22
	Others	80.7	19.3	2.39	2.67	0.55 - 12.87
Religion	Christian	75.3	24.7	1.0	1.0	
	Moslem	70.0	30.0	1.31	1.33	0.87 - 2.03

[1] Standard deviation

[2] Adjusted for age, education and ethnicity in a logistic regression model with 95% confidence interval (CI) for each of the variables

Table 3

Crude and adjusted odds ratio of food insufficiency for men by socio-demographic characteristics in the Kahe Study, Kilimanjaro

Variable	Category	Percent of		Odds ratio		
		Food sufficient (n = 310)	Food insufficient (n = 92)	Crude	Adjusted[2]	95% CI
Age (years)	Mean ± SD[1]	22.3 ± 70	23.3 ± 7.0	1.02	1.02	0.98 - 1.06
Number of children	Mean ± SD	2.1±1.3	2.5±1.6	1.23	1.31	0.93 - 1.85

Table 3 (*continued*)

Variable	Category	Percent of Food sufficient (n = 310)	Percent of Food insufficient (n = 92)	Odds ratio Crude	Odds ratio Adjusted[2]	95% CI
Children present	No	79.5	20.5	1.0	1.0	
	Yes	71.8	28.2	1.56	1.67	0.82-3.36
Occupation	Peasant	73.9	26.1	1.39	1.24	0.60-2.53
	Employee	100	0	-	-	NS
	Petty business	75.0	25.0	1.31	1.31	0.51-3.37
	Student	79.7	20.3	1.0	1.0	
Education	No formal education	81.2	18.8	0.96	1.10	0.38-3.14
	Primary education	75.5	24.5	1.34	1.40	0.58-3.34
	Secondary education+	80.6	19.4	1.0	1.0	
Marital status	Single	78.8	21.2	1.0	1.0	
	Married/cohabiting	76.2	23.8	1.16	0.87	0.40-1.87
	Previously married	40.0	60.0	5.57	4.35	0.66-28.78
Ethnicity	Kamba	94.7	5.3	1.0	1.0	
	Pare	71.6	28.4	7.14	7.55	0.97-58.46
	Chagga	79.4	20.6	4.68	4.94	0.61-39.42
	Kahe	85.7	14.3	3.00	3.03	0.31-29.54
	Zigua	70.6	29.4	7.50	7.80	0.80-75.65
	Others	79.7	20.3	4.57	4.56	0.56-36.84
Religion	Christian	78.9	21.1	1.0	1.0	
	Moslem	74.0	26.0	1.32	1.27	0.78-2.01

[1] Standard Deviation

[2] Adjusted for age, education and ethnicity in a logistic regression model with 95% confidence interval (CI) for each of the variables

Table 4

Health indicators and HIV status of men and women and their odds of reporting food insufficiency

Health indicator	Category	Percent of Food sufficient	Percent of Food insufficient	Odds ratio Crude	Odds ratio Adjusted[1]	95% CI
Men						
Health perception	Healthy	77.4	22.6	1.0	1.0	
	Not healthy	72.7	27.3	1.29	1.26	0.32 - 4.87
Has a health problem	No	78.2	21.8	1.0	1.0	
	Yes	72.7	27.3	1.35	1.17	0.50 - 2.271
HIV status	Negative	77.6	22.4	1.0	1.0	
	Positive	75.0	25.0	1.15	1.05	0.27 - 4.04
Women						
Health perception	Healthy	74.5	25.5	1.0	1.0	
	Not healthy	36.4	63.6	5.10	4.62	1.80 - 11.82
Has a health problem	No	76.1	23.9	1.0	1.0	
	Yes	59.3	40.7	2.19	2.47	1.32 - 4.58
HIV status	Negative	74.4	25.6	1.0	1.0	
	Positive	52.2	47.8	2.67	2.12	0.87 - 5.19

[1] Adjusted for age, education and ethnicity in a logistic regression model with 95% confidence interval (CI) for each of the variables

DISCUSSION

Our study suggests that food insufficiency may have been prevalent in this rural population during the post-harvest food abundant season. In this context, the proportion of individuals reporting food insufficiency was lower than what has been estimated by FAO 2, and observed in other developing countries and Africa 5-8. Although an attempt was made to compare our findings with other studies, great caution was taken due to the various methodological definitions used in assessing food insecurity as well as the seasonal differences in food insufficiency. The low prevalence of reported food insufficiency observed in our results may be explained by the seasonal variation in food production and availability experienced in rural Tanzania. This study was conducted between June-August which according to community surveys is the dry post-harvest season and hence coincides with abundant food availability to most households (18). The lack of a significant difference in reported food insufficiency between men and women in this study is contrary to what was observed in Australia (11). Underreporting by female participants may explain this finding. It is possible that women considered the question to be personal and thus may not have reported their true household situation due to embarrassment.

Food insufficiency has been associated with poverty indicators such as low income, unemployment, low education levels, female headed households and presence of children in the households (3-8,11,16). In this study the measure of food insufficiency appeared to also track poverty indicators as shown by the associations with age, low education level, having children and occupation. These observations are consistent with other studies (4,6).

Food insufficiency was however not associated with socio-demographic characteristics among men. The inability of the measure to differentiate food insufficiency among men in relation to socio-demographic characteristics as was observed in Australia (11) may lie in the development of the measure. It is conceivable that self reported food insecurity measures that were mainly developed primarily from the experiences of women in developed countries are less sensitive to the male population. More research is needed to further explore the use of self reported food insecurity measures among male respondents.

Plausible biological mechanisms have suggested associations between negative health outcomes and food insufficiency. As reported in other studies the likelihood of food insufficiency being reported by women in our study increased with poorer self- rated health and presence of a health problem (4,10,19).

One of the greatest health challenges in Tanzania is HIV infection. The prevalence is estimated to be 2.4% to 20% depending on geographic location and the population studied (20). Our finding of a 4.2% HIV prevalence was within the expected range for a rural population in Tanzania. Several FAO publications (21,22) and other studies (23) have suggested an intertwined and crucial relationship between food insecurity and HIV / AIDS, particularly in sub-Saharan Africa. We found an association between food insufficiency and HIV / AIDS among women although it did not remain significant after adjusting for socio-demographic factors. The absence of a significant association between food insufficiency and HIV / AIDS may be explained by the small sample and limited number of HIV cases found.

Nevertheless, food insecurity is important in the fight against HIV / AIDS and should be further pursued. At both the individual and social level food insecurity represents a risk for HIV infection (24). Food insecurity may increase susceptibility to HIV infection through malnutrition and contribute to the destruction of the immune system leading to faster progression to full blown AIDS for persons living with HIV. At the social level, food insecurity may increase vulnerability by conditioning behaviours such as migration, multiple sexual partners, transactional sex and poor negotiation ability (23).

The strength of our study lied in the ability to use a self reported food insufficiency measure to assess food insecurity in a rural setting. The fact that 75% of the individuals agreed on being classified as food insufficient based on perceptions and the degree of association observed being in a range that is considered to indicate an acceptable level of agreement for this situation provided strong evidence for inter-informant reliability of the single question (24). Further characterisation of individuals without exact agreement was beyond the scope of this paper.

The interpretation of our findings had limitations. First, this study only estimated the magnitude of

perceived food insufficiency, whereas a majority of recent studies use measurements that have a broader definition. Secondly, the findings are limited by the inability of a cross-sectional study design to infer causality to the observed associations.

CONCLUSION

Food insufficiency was a prevalent problem in this rural population during the post-harvest food abundant season. Identified socio-demographic factors associated with food insufficiency among women included age, education level, presence of children, occupation and ethnicity. Poor self rated health and presence of a health problem particularly among women were associated with increased reporting of food insufficiency. Food insufficiency may play a role in increasing vulnerability to HIV infection in the women population. Our results help in understanding the determinants of food insufficiency in the rural population and the link it has with health. The relationships observed suggest that these factors may be useful indicators in identifying households and individuals at risk of food insufficiency.

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