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DIETARY DIVERSITY AMONG SMALLHOLDER HOUSEHOLDS IN BUKOBA DISTRICT, TANZANIA AND KIBOGA DISTRICT, UGANDA

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ABSTRACT

Undernutrition in developing countries continues to affect 780 million people resulting in poor growth and development; increasing the burden of disease and imposing a number of costs on the affected countries. The aim of this study was to establish the dietary diversity and consumption patterns among small-holder farming households. A cross-sectional study was carried out in Kiboga district, Uganda and Bukoba district, Tanzania with 220 and 199 households, respectively. Results from the 24 hour recall showed that white roots, tubers and bananas were the most consumed food group in the two districts with a significantly higher consumption in Kiboga than Bukoba. However, households in Bukoba had higher dietary diversity scores compared to those in Kiboga even though both districts had 52% of the households consuming diets with moderate dietary diversity. The percentage of households consuming vitamin A rich vegetables and fruits, and animal protein (flesh meats, organ meats and eggs) was negligible. There was no significant difference between food group consumption at household level and that of the youngest 6-59 month-old child within these households. High consumption of a food group and absence of a food group by the whole household was matched by the consumption of the children. Only 48% and 35% of caregivers in Kiboga and Bukoba, respectively reported preparing special meals for the child. Younger caregivers, ability of households to rent out land, and distance to market were variables that significantly influenced intake of vitamin A and iron but not protein. The results highlight opportunities for the promotion of vitamin A- rich fruits and vegetables, and protein foods in between the main household meals of the day, as well as avenues through which nutrition education can be reinforced to improve the knowledge and skills of the households, especially the decision makers and care givers of children under five years of age.

Key words: Dietary diversity, Food groups, Household consumption, Smallholder, Vitamin A, Protein

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INTRODUCTION

The world's greatest challenge is to secure sufficient and healthy food for all, in an environmentally sustainable manner [1]. Great strides have been made in the reduction of the prevalence of malnutrition, especially under nutrition. In the last 16 years, the number of undernourished people in the world has fallen by 135 million. There, however, remain 795 million undernourished people, majority from developing countries: 780 million [2]. Malnutrition and poor diets are the largest risk factors for the global burden of disease, imposing large human, economic, fiscal, and social costs on the affected countries [3,4]. Energy and micronutrient deficiency contribute to the 165 million stunted children under five years of age [4]. Vitamin A deficiency is compromising the immune systems of approximately 40% of the developing world's under-fives and leads to the deaths of approximately 1 million young children each year [5]. Given that individuals and households will diversify into higher value micronutrient- and protein- rich foods such as meats, fish and dairy products only when they have satisfied their basic calorie needs and on the other hand shift to low value calorie food sources when faced with limited income, vulnerable population groups in Eastern Africa are seen to be reliant on starchy staples with minimal consumption of fruits, vegetables and animal source proteins [6].

In Uganda and Tanzania, the levels of vitamin A deficiency are 39% and 43%, respectively [3]. Half (53%) of children 6-59 months and 32% of women of child bearing age are reported to have iron deficiency anaemia in Uganda [7]. In Tanzania the prevalence of iron deficiency anaemia among children 6-59 months and women of child-bearing age is 58% and 45%, respectively [8]. These reported values indicate that iron and vitamin A deficiency are still major problems of public health concern in both Tanzania and Uganda. Although other factors such as high disease burden could be contributing to the nutrition problems, one of the main factors is poor dietary practices. Studies have shown higher levels of malnutrition among children from banana-dependent regions, where the majority of children are weaned on boiled banana [9]. This paper, therefore, reveals findings of a study carried out to establish the consumption patterns and dietary nutrition intake of households and children from banana-dependent regions of Kiboga District in Central Uganda and Bukoba District in North Western Tanzania.

METHODOLOGY

Research design and study sites

A cross-sectional survey was used to assess the consumption patterns of households and children aged 6 to 59 months. The study was conducted in Kiboga district, Uganda and Bukoba district, Tanzania. These two districts were purposively selected based on their high reliance on banana for both food and income [9,10]. Kiboga district is located in the central region of Uganda while Bukoba district is located in the Kagera region of Northwest Tanzania.

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Sampling methodology

Multistage sampling techniques were used to establish the households selected for the sample. In Kiboga district, Uganda, one sub-county was selected, followed by two parishes within the sub-country. The sub-county and parishes were purposefully selected based on their high reliance on agriculture and high poverty levels [11]. Eight and five villages were randomly selected from the parishes of Kisweeka and Ssinde, respectively. All eight villages are in rural areas. In Bukoba district, Tanzania, Izimbya ward was purposively selected based on high level of food insecurity reported and high reliance on agriculture, especially banana production for both food and income [10]. From the two main villages in the ward, Izimbya and Rugaze, two sub-villages were randomly selected for a total of four sub-villages from Izimbya ward. The main village in Tanzania is equivalent to a parish in Uganda.

Sample size determination

Fisher's formula [12] was used to calculate the total sample size in both Kiboga and Bukoba based on proportionate size sampling approach. The total population of Lwamata sub-county in Kiboga is 20,644 and the proportion of children 6-59months to the general population is 17.2% [13]. Thus, the resulting sample size in Kiboga was 220 households. In Tanzania, Izimbya Ward has a total population of 16,916 and the proportion of children aged 6-59 months to the general population is 16% [14] resulting in a sample size of 206 households. The specific households were identified through systematic random sampling using a list of all households in the villages in Kiboga and sub-villages in Bukoba with at least one child aged 6-59 months. If a household had two children within the specified age range, the youngest child was selected. Households without children in the specified age range and without at least one parent or caregiver present at the time of the study were excluded.

Data collection and variable construction

A semi-structured questionnaire was administered by trained enumerators to the mother or care giver of the selected children within the sampled households. The tool was pretested in villages in Kiboga and Bukoba that were not sampled for the study. The questionnaire assessed socio- economic characteristics of the household, a 24 hour food recall, as well as child health and feeding practices.

The 24 hour food recall was used to determine the food frequency of the households and that of the children for the previous day by evaluating the percentage consumption of the different food groups at the different meals. The seventeen food groups evaluated were cereals; white roots, tubers and bananas; legumes and pulses; dark green vegetables; vitamin A-rich vegetables; other vegetables; vitamin A-rich fruits; other fruits; organ meats; flesh meats; eggs; fish; milk and its products; insects; oils and fats; sweets and sugars; and condiments. The food group white roots, tubers and bananas included foods such as cooking bananas, potatoes, cassava, white sweet potatoes and yams. Vitamin-A rich vegetables included foods such as orange-fleshed sweet potatoes, carrots, and pumpkin.

In addition to the percentage consumption of the 17 food groups, data from the 24 hour recall were also used to calculate the household-level dietary diversity scores (DDS). A

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score was given for each of 12 food groups if consumed at least once in the previous day. The food groups considered in the calculation of the household DDS were: cereals; white roots, tubers and bananas; vegetables; fruits; meat; eggs; fish; legumes; milk and its products; oils and fats; sweets; and condiments. The DDS was given as the sum of the scores for each household. The mean and tertiles of the scores were calculated. The household DDS were also grouped into three categories: low DDS (≤3 food groups), medium DDS (4-5 food groups) and high DDS (≥6) [15, 16].

Data analysis

Descriptive statistics were determined using SPSS version 17. Comparisons were made between findings in Bukoba, Tanzania and Kiboga, Uganda. For quantitative variables, independent sample t-tests were used for comparison. While for categorical responses, chi- square tests were performed to test significant differences between Bukoba and Kiboga. Multiple linear regression models were run to determine the socio-economic factors influencing intake of vitamin A, iron, and protein rich foods by the children. Seven questionnaires from Bukoba were incomplete and thus not included in the analysis, resulting in a sample size of 199 households. All the 220 questionnaires from Kiboga were analysed.

RESULTS AND DISCUSSION

Demographic characteristics of the households

Majority of the respondents in Tanzania and Uganda were women (80%). This could be due to already observed scenario where care of children is a role mostly performed by the women in most patriarchal societies in Africa. The caregivers were generally young with an average age of 34 years which is a reflection of the sampling technique which required households with younger children. Most of the caregivers were in monogamous marriages (>50%). The study observed lower household sizes as compared to the national averages in all the two sites. Twenty-three percent (23%) of households in Kiboga and thirty-three percent (33%) in Bukoba had at least one member belonging to an organization/association/Government program involved in food production and nutrition activities (Table 1). Previous studies have shown that being a member of a group or an association especially among smallholder farmers enhances their access to services such as information, technologies, innovations and extension services, which increases the likelihood of more sustainable livelihoods and improved food security in the community [17].

The main sources of income for majority of the households (>55%) interviewed in both Kiboga and Bukoba was farming: arable and mixed farming (Table 1). These were followed by business in both districts. The estimated monthly household expenditure in Kiboga and Bukoba was less than $50 for 70% and 93% of the households, respectively. This could indicate the dependence of these households on their farms for food and income.

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Consumption patterns

Household consumption of different food groups

Findings from the study showed that white roots, tubers and bananas were by far the most consumed food group in the two districts (Table 2). The households consumed at least one food item from this group twice within the 24 hours preceding the survey. The consumption of this food group was significantly higher in Kiboga than Bukoba (P=0.0001). The second and third most consumed food groups for both districts were legumes and cereals, respectively, with Bukoba having consumed cereals significantly more times than Kiboga. The fourth food group in Kiboga was other fruits while for Bukoba, it was fish.

The percentage of households consuming vitamin A-rich vegetables and fruits, and animal protein foods (flesh meats, organ meats and eggs) was negligible. Although, the mean number of times that other fruits, dark green vegetables, and other vegetables were consumed was less than one time, they were consumed significantly more times by households in Kiboga than in Bukoba. On the other hand, households in Bukoba consumed fish, milk, vitamin A-rich vegetables, flesh meats, and oils significantly more times than in Kiboga.

These findings are generally in agreement with reports from the region that diets are mainly composed of starchy staples especially cereals and roots, tubers and bananas compared to other food groups. Legumes constitute the main protein source and consumption of fruits and vegetables and animal source proteins is low when compared to other food groups and the individual nutrient requirements [7, 8, 9, 18, 19]. The higher consumption of fish in Bukoba compared to Kiboga can be attributed to the proximity of Lake Victoria to Bukoba district compared to the proximity of any large lake to Kiboga district.

The availability and consumption of fruits and vegetables in the rural areas are affected by household production, seasonality, and income [19, 20]. Rural markets are more limited in the variety of fruits and vegetables available compared to urban markets and in addition, rural households are unable to afford constant purchase. For those that produce fruits and vegetables, a large number are sold to meet the high demand from urban areas [21, 22]. Consumption of fruits and vegetables by children also depends on preferences that are modelled by availability, variety and repeated exposure [23]. Empowering the households with improved skills and knowledge on production of fruits and vegetables even in the off- season, and nutrition education on their importance may likely improve their consumption [20, 24]. This is beneficial for not only the current dietary patterns and nutritional status of the children but also when they are adults since childhood feeding contexts shape the establishment of life-long healthy eating habits [23]. Given the cross- sectional nature of the study, differences in the consumption of fruits and vegetables will probably vary if recorded in a different season from that in which the study was carried out.

In Kiboga, white roots, tubers and bananas; cereals; legumes; and milk were consumed throughout the day (Table 3). White roots, tubers and bananas and legumes were mainly consumed during breakfast (54% and 11%, respectively), lunch (48% and 28%,

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respectively) and dinner (45% and 28%, respectively), thus making up the main household meals. Within these two food groups, the most common food items were the green cooking bananas and beans. On the other hand, cereals and milk were mainly consumed during breakfast (18% and 7%), mid-afternoon (15% and 5%, respectively) and before bed (44% and 31%, respectively). This is due to consumption of porridge and/or milk (plain or in tea), especially by the children. Other fruits were the most consumed as snack, 69% in the mid-morning and 58% in the mid-afternoon. Less than 1% of the households consumed any food items from the vitamin A-rich vegetables, vitamin A-rich fruits and eggs groups. None of the households interviewed in Kiboga had consumed any food items from the flesh meats groups or used any fats/oils in preparing their meals (Table 3). These results also reflected breakfast, lunch and dinner as the main meals for households in Kiboga, with 81%, 92% and 98% of the households consuming these meals, respectively. In addition, these meals had the highest number of food groups reported, 13, 10 and 12 food groups, respectively (out of 17 food groups).

In Bukoba, the food groups that were consumed throughout the day were white roots, tubers and bananas and cereals (Table 4). White roots, tubers and bananas and cereals were mainly consumed mid-morning (42% and 38%, respectively), lunch (40% and 37%, respectively), and at dinner for the white roots, tubers and bananas (55%) and after dinner for cereals (58%). Consumption of fish and dark green vegetables varied throughout the day, having been recorded for at least one in the five meals in the day in Bukoba. Fish was mainly consumed in the mid-afternoon (1.9%) and at dinner (2.2%), while the dark green vegetables at lunch (4.6%) and in the mid-afternoon (9.2%). The other food groups whose consumption varied throughout the day were legumes and other vegetables that were consumed for at least one in 4 meals in the day. Legumes were mainly consumed at dinner time (9%), while other vegetables in the mid-afternoon (3.8%). Less than 2% of the households consumed any food items from the vitamin A- rich fruits, flesh and organ meats. Breakfast, lunch and dinner were the most consumed meals by the households in Bukoba with 71%, 93% and 93%, respectively. The meals with the highest number of food groups observed were lunch, mid-afternoon and dinner with 11, 14, and 13 groups, respectively (Table 4).

The average number of meals per day reported by the households in the 30 days preceding the study was 2.4±0.7 in Kiboga and 2.5±0.6 in Bukoba. The observed spread of the different food groups consumed throughout the day, in conjunction with the average number of meals per day reported by the households in the 30 days can be used to stipulate that the children in these households have access to food throughout the day. The in-between meal periods (mid-morning and mid-afternoon) also provide an opportunity for promotion of consumption of fruits and vegetables. Emphasis, however, needs to be placed on vitamin A-rich fruits and vegetables because consumption of other fruits in Kiboga was notably higher than that of other vegetables, or vitamin A-rich fruits and vegetables.

Given that the children's diets are similar to the diets of the rest of household members, the young child feeding practices are wanting. The first household meals of the day for majority of the households were composed of one food group only. For example, the only protein foods recorded for breakfast in Bukoba were milk (6%) and eggs (1%)

unlike Kiboga that had legumes (11%), milk (7%), fish (1%), organ meats and eggs (>1%) at breakfast (Tables 3 and 4). Guidelines for feeding infants and young children recommend feeding of children food items from at least 4 different food groups out of 7 food groups that exclude oils, sweets and sugars, and spices each day. Thus, emphasizing the importance of flesh foods (meats), dairy products, and vitamin A-rich fruits and vegetables [25, 26]. With the exception of milk (46%), consumption of other animal source foods and vitamin A-rich fruits and vegetables in Kiboga was less than 13%. A similar gap was also observed in Bukoba where, though the consumption of vitamin A-rich vegetables was 19-21%, animal source foods were at 11% and vitamin A-rich fruits 2%. These observations are much lower when compared to the recorded national values for children aged 6 to 23 months in Uganda and Bukoba for vitamin A-rich fruits and vegetables at 41% and 67% respectively; for meat and eggs at 35% and 37%; and milk and its products at 3% and 27%, respectively [7, 8].

Dietary diversity

There was no significant difference observed between food group consumption at household level and of the youngest 6-59 month old child within the households (Table 5). Absence of a food group in the household diet was matched by its absence in the child's diet as seen for vitamin A-rich fruits, flesh meat, eggs, and oils in Kiboga and vitamin A-rich fruits, organ meats, and insects in Bukoba. There was also a matched high consumption by both the whole household and child (>50%) for white roots, tubers and bananas, legumes, and other fruits in Kiboga. In Bukoba, a similar picture was observed with >50% consumption by household and child for white roots, tubers and bananas, legumes, cereals, and fish.

The results indicate that close to half of the families in the study were keen on preparing special meals and/or serving additional meals in order to meet the nutrient needs of the children. Forty four percent of the caregivers in Kiboga and thirty five percent in Bukoba reported preparing special meals for the child. The main reasons given by those that did not prepare special meals were lack of time, lack of food, and the child being old enough to wait for and share the family meals. The children generally ate the family meals. Children's meals were mainly decided on and fed by the mothers in both sites: 86% of mothers deciding and feeding in Kiboga and 87% of mothers deciding and 90% feeding in Bukoba. More fathers in Bukoba (25-28%) played a role in the feeding of the child (deciding and feeding) compared to Kiboga (5-7%). The number of households preparing special meals for children is similar to previously reported figures for Uganda [9]. This situation also corresponds with reports that the number of food groups consumed by children increases with age [7, 18]. In addition, children aged 9-11 and 12-23 months have been found to be more likely to meet their minimum dietary diversity compared to those aged 6-8 months [27]. This could be due to the fact that as the children grow, they are able to obtain for themselves food and/or snacks such as fruits and vegetables during the day outside the main family meals. Also, higher household dietary diversity and thus food availability increases the chances of children meeting their minimum dietary diversity [27].

Generally, households in Bukoba had higher dietary diversity scores (DDS) compared to those in Kiboga even though both districts had 52% of the households having moderate

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dietary diversity (4-5 food groups). In Bukoba, 32% had high dietary diversity (≥6 food groups) while 16% had low dietary diversity (≤3 food groups). In Kiboga, 6% had high dietary diversity while 42% had low dietary diversity. The mean DDS in Bukoba was 4.9±1.5 with 25% and 50% of the population with a score of five, and 75% at DDS of six. On the other hand, the mean DDS in Kibogawas 3.7±1.1 with 25% of the population with a score of three, 50% and 75% at a DDS of four.

Dietary diversity is used to reflect the dietary quality of a household or individual's diet; it is associated with improved nutrition outcomes as higher dietary diversity increases the probability that nutrient intake levels shall be met [15, 28, 29]. Particularly for households, this score can be used to reflect the household economic access to food [16].Consumption of at least four food groups increases the likelihood that animal source foods and fruits and vegtables shall be consumed in addition to the staple foods [30, 31].

The dietary diversity of the households, particulary children below 59 months in Kiboga and Bukoba thus greatly needs to be addressed and improved. Since health professionals were the main source of information on infant and young child feeding in both districts (41% in Kiboga and 58% in Bukoba), they provide an opportunity to reach mothers and caregivers with adequate information on nutrition. Another opportunity lies with village health teams and other commnuity personnel that can be trained in essential nutrition actions and equipped to reach fellow community members.

Consumption of dietary protein, iron, and vitamin A

Results from the multiple linear regressions in Table 6 showed that the children in Tanzania (Bukoba) were significantly better off than the children in Uganda (Kiboga) with regard to vitamin A, protein and iron intake. Younger caregivers were better in providing these nutrients to the children than the older caregivers and the difference was significant for vitamin A and iron. Households that rented out land were able to provide more nutrients than those who did not rent out. Renting out land indicates the self-sustainability of the households and increased ability to meet both the quantity and quality of food required than the households that borrow land. Availability of and size of land for agriculture has been associated with improved dietary diversity as it improves food availability for the household. In addition, the larger the land size, the higher the likelihood that the household has enough food to meet their needs [32, 33].

Institutional variables such as distance to market were significant for vitamin A and iron but not protein. Shorter distances not only improve access by the caregivers to buy food but also sell food thus increasing income. Contribution of the diets of the children in Kiboga in meeting the daily requirements of protein, vitamin A and iron are elaborated in a separate publication [34]. Other studies have also found residence in a rural area, larger household size, low education level of the household head, particularly the female head, low income and low or no presence of non-farm enterprises to influence diet quality and reduce the household DDS [19, 32, 33, 35]. Studies in Indonesia and Cambodia have also shown a relationship between animal source foods and stunting, with those consuming these foods less likely to be stunted [37, 38]. The bioavailability of protein, iron and vitamin A is higher in animal source foods than in plant source foods, yet the availability and consumption of animal source foods by majority of rural households

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such as those in this study are inadequate [39, 40]. In order to meet the protein, iron and vitamin A requirements using plant foods, adequate amounts need to be consumed and measures to reduce anti-nutritional factors, reduce nutrient losses and improve nutrient quality during processing, storage and preparation are needed. Methods include but are not limited to dehulling, soaking, cooking, fermentation and germination; increasing intake of enhancers of iron absorption like ascorbic acid; and appropriate handling of food [41, 42, 43].

Based on the findings of this study, recommendations for district entities and organisations promoting food security and nutrition within the study districts, are for them to include promotion of on-farm diversity of crops grown, particularly vitamin A and iron rich foods such as leafy green vegetables and orange fleshed fruits. This can improve availability and reduce the effect that distance to markets has on the consumption of dietary protein, vitamin A and iron. On-farm diversity should also be accompanied by promotion of dietary diversity, appropriate food combination and preparation and preservation techniques to improve the quality of their diets while catering for the resource, labour and time burden faced by the care givers.

CONCLUSION

In both Bukoba district, Tanzania and Kiboga district, Uganda the most popular food groups were white roots, tubers and bananas. The consumption of animal source foods, fruits and vegetables was negligible in both districts. The preschool children in these two districts did not receive any special attention with regard to the diets consumed: their meals were not significantly different from those of the general household. There is, therefore, the need and opportunity based on the present agro-biodiversity in these districts to improve the diets through awareness creation on appropriate food combination and preparation techniques and inclusion of more nutrient rich foods in their diets for increased dietary diversity.

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Table 1: Demographic characteristics of households in Kiboga and Bukoba

Characteristic		Kiboga (n=220)	Bukoba (n=199)	t-test[a]
Gender of respondents (%)	Male	18.64	20.87	0.563
	Female	81.36	79.13	
Age of the caregivers (years)		33.9 (15.1)	34.0 (11.3)	0.9846
% of HHH as respondents		41.8	27.8	0.0024
Age of spouse (years)		37.4 (12.6)	37.1 (8.5)	0.0001
Marital status (%)	Single	13.2	2.4	
	Monogamously married	57.4	79.5	
	Polygamous married	19	10.2	0.6572
	Widowed	6.8	4.4	
	Separated/ divorced	3.7	3.4	
Household size		3.4 (1.2)	3.1 (1.1)	0.0074
% belonging to an organization		22.7	31.7	0.1837
Time to closest safe water source				0.0179
	<15 Minutes	35.4	39	
	About 30 minutes	21.8	26.8	
	>30 Minutes	50.5	34.2	
Distance to closest open-air market				0.0001
	< 1km	39.6	20.5	
	1-3km	46.8	25.4	
	>3km	13.6	54.1	
Estimated monthly Expenditure[#]	Less than $50	70	92.5	
	Above $50	30	7.5	
Main sources of income[#]	Arable farming	28.6	32.8	
	Mixed farming	27.1	33	
	Business	15	16.2	
	Casual labour	7.6	5.5	
	Cattle farming	6.6	1.4	
	Brick making	2.3	4.6	
	Mat/ broom making	3	3.5	
	Employment	9.7	2.9	

Figures in parenthesis () are standard deviations; HHH refers to household head
[a]Comparison between Kiboga, Uganda and Bukoba, Tanzania
[#]Percentage proportion of households

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Table 2: Average number of times the food groups were consumed by the households over 24 hours

Food group	Kiboga	Bukoba	P-value
Cereals	0.69	1.04	0.030
White roots	2.32	1.65	0.001
Vitamin A vegetables	0.01	0.07	0.0043
Dark green vegetables	0.19	0	0.001
Other vegetables	0.16	0.06	0.015
Vitamin A fruits	0.01	0	0.319
Other fruits	0.66	0.04	0.001
Organ meats	0.04	0	0.032
Flesh meats	0	0.07	0.001
Eggs	0.01	0.01	0.656
Fish	0.22	0.66	0.001
Legumes & pulses	1.14	1.15	0.960
Insects	0.02	0	0.103
Milk	0.15	0.21	0.288
Oils	0	0.10	0.001

Table 3: Percentage of households that consumed the different food groups over a 24 hour period in Kiboga

	Breakfast	Snack Mid-morning	Lunch	Snack Mid afternoon	Dinner	Snack-before bed	24-hours
Cereals	18.3	7.2	7	15.1	9.6	43.8	54.5
White roots	54.2	12	48.4	15.8	44.6	12.5	96.8
Legumes	10.6	1.1	28.3	1.7	28.2	12.5	71.8
Other fruits	1.5	68.5	0.8	58	0	0	58.4
Milk	7.3	1.4	0.8	5	0.7	31.3	16.8
Fish	1.1	0	4.9	0	6.9	0	20.5
Dark green vegetables	1.5	0	5.8	0	4.1	0	18.2
Other vegetables	2.2	0	3.3	0	3.3	0	13.6
Sweets and Sugars	1.1	9.1	0	14.3	0	0	13.6
Organ meats	0.7	0.4	0.5	0	1.1	0	3.2
Insects	0	0	0.3	0	0.7	0	1.8
Vitamin A vegetables	0.4	0.4	0	0	0.1	0	1.4
Eggs	0.4	0	0	0	0.2	0	0.4
Vitamin A fruits	0	0	0	0	0.2	0	0.2
Spices	0.7	0	0	0	0	0	0.7
Flesh meats	0	0	0	0	0	0	0
Oils	0	0	0	0	0	0	0
Total per meal	80.5	57.3	91.8	25.0	97.7	2.7	100

ajfand SCHOLARLY, PEER REVIEWED
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Volume 18 No. 1
April 2018
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Table 4: Percentage of households that consumed the different food groups over a 24 hour period in Bukoba

	Breakfast	Snack Mid-morning	Lunch	Snack Mid afternoon	Dinner	Snack-before bed	24-hours
White roots	2.5	42	39.8	11.3	55.1	0.7	100
Legumes	0	1.1	0.2	1.9	9	0	81
Cereals	20.4	37.8	36.9	9.4	2.2	58.3	71.8
Spices	67.9	14.3	0.8	16.9	6.6	0	71.8
Fish	0	0.2	0.2	1.9	2.2	0.4	56.3
Sweets and Sugars	0.6	9.8	0	20.8	12.4	0	55.8
Milk	5.6	1.4	0	3.8	0	0	12.6
Other vegetables	0	0	1.9	3.8	2.2	0	11.7
Oils	0.6	0	0.4	1.9	0	0	11.2
Flesh meats	0	0	0	0	1.1	0	8.3
Vitamin A vegetables	0	5.6	13.8	0	1.1	0.7	6.8
Other fruits	0.6	0	0.8	5.7	0	0	4.3
Dark green vegetables	0	0.9	4.6	9.4	2.2	2.3	2.9
Eggs	1.2	0	0	5.7	2.2	0	1.5
Vitamin A fruits	0	0	0.4	0	1.1	0	0.4
Insects	0	0	0	0	0	0	0.3
Organ meats	0	0	0	1.9	0	0	0.4
Total per meal	71.4	22.3	92.7	9.1	92.7	0.5	100

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Table 5: Food group consumption by the general household and that of the children aged 6-59 months

Food group	Kiboga		Bukoba	
	% of hh consuming	% of children consuming	% of hh consuming	% of children consuming
Cereals	54.5	40	71.8	63.6
White roots	96.8	91.4	100	83.4
Legumes	71.8	68.2	81	67.5
Vitamin A vegetables	1.4	0	6.8	5.3
Dark green vegetables	18.2	14.5	2.9	1.9
Other vegetables	13.6	10.5	11.7	5.3
Vitamin A fruits	0.2	0	0.4	0
Other fruits	58.2	54.5	4.3	3.9
Organ meats	3.2	2.3	0.4	0
Flesh meats	0	0	8.3	5.3
Eggs	0.4	0	1.5	1.5
Fish	20.5	17.3	56.3	45.1
Insects	1.8	1.4	0.3	0
Milk	16.8	13.2	12.6	11.7
Oils	0	0	11.2	7.8
Sweets and Sugars	13.6	1	55.8	51
Spices	0	0	71.8	61.7

Figures are percentage proportion of households; hh= household
No significant difference between number of households consuming a particular food group and the child between 6-59 months also consuming it

ajfand SCHOLARLY, PEER REVIEWED
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Volume 18 No. 1
April 2018
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ISSN 1684 5374

Table 6: Factors influencing intake of vitamin A, iron and protein

Variable	Vitamin A		Iron		Protein	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Country	0.702	0.001	0.663	0.001	0.686	0.001
Age of care giver	0.011	0.045	0.006	0.075	0.001	0.754
Marital status	-0.079	0.286	-0.006	0.89	-0.078	0.122
Membership in organisation	-0.008	0.961	0.096	0.306	0.089	0.405
Household size	0.012	0.725	0.008	0.708	0.01	0.656
Time to water source	-0.102	0.078	-0.021	0.548	-0.06	0.134
Distance to market (log)	-0.199	0.028	-0.104	0.054	-0.085	0.166
Distance to health centre (log)	0.409	0.14	0.086	0.394	-0.001	0.996
Monthly income	0.048	0.547	0.047	0.326	0.902	0.098
Rented out land	0.148	0.296	0.168	0.048	0.17	0.08
Constant	1.994	0.001	0.211	0.001	1.886	0.001
	n=385 Prob>F=0.0001 Adj R-squared=0.0724		n=404 Prob>F=0.0001 Adj R-squared=0.0881		n=405 Prob>F=0.0001 Adj R-squared=0.0711	

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AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
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