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Determinants for children's malnutrition in Nadunget and Namalu sub-counties in Karamoja, Northern Uganda

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Abstract

Objective: The objective of this study was to identify determinants and causal chains for malnutrition of children in two districts of Karamoja.

Methods: A mixed methods study was conducted in August 2016 comprising 7 focus group discussions (FGD) with mothers with children < 5 years and 2 FGD with health staff followed by a survey to assess the knowledge, attitudes and practices (KAP) of women with children below two years of age (n=424) on infant and young child feeding practices, dietary intake, agriculture and livestock keeping practices.

Results: The results of the KAP survey confirmed that despite the various efforts the level of dietary diversity among children is still low. Only 32% of the children (6-23 months) (n=298) reached the WHO recommendation on minimum dietary diversity (MDD). Children with mothers owning livestock were more likely to achieve MDD (39% vs. 30%, p<0.05). Animal source foods were poorly consumed by the children. Further results revealed inadequate feeding practices. Although knowledge regarding nutrition and hygiene was high, women were unable to put these messages into practice. Care practices were a challenge in the region. Infants and children were left in care of older siblings or another family member while mothers went to work. Beer brewing was an alternative income source for women. FGD revealed that mothers used local beer and the residue left after the brewing to calm hungry children.

Future strategies should include improvement of child caring system and reinforcement of nutrition education in a participatory learning manner to close the gap between knowledge and practice.

Introduction

Malnutrition affects all regions in Uganda. According to the most recent Uganda Demographic and Health Survey of 2016, key nutrition indicators for young children and their mothers are improving. However, malnutrition rates in the Karamoja region remain a concern. The Karamoja Region in North-East Uganda covers about 1 million km² and is inhabited by 1.2 million people. Traditionally, the inhabitants in central and southern Karamoja are agro-pastoralists with an emphasis on livestock. The percentage of children aged 6 to 59 months with any anaemia in the region is about 68 % and 47.4 % of the children under five are stunted. Only 22.5 percent of the children, aged 6 to 23 months achieved minimum dietary diversity and 13 percent achieved a minimum acceptable diet (UBOS and ICF, 2018). A nutrition, report based on field data of June 2015 (N=5027), states that specially in Moroto and Nakapiripirit Districts the Global Acute Malnutrition rates (GAM) are high (14.3 % and 24 %), were 32% of the children (< 5 years) in the districts Moroto (46.1% in Nadunget Sub county)

and 30% in Nakapiripirit (39.1% in Namalu sub county) are stunted. Wasting rates vary between 18-15% in the region (WFP Uganda & UNICEF, 2015).

The Ugandan government and the donor community wonder about the persistent high malnutrition rates despite numerous investments on poverty reduction. The High Level Panel of Experts on Food Security and Nutrition commissioned by the Committee on World Food Security hosted within FAO stated in its report "What roles for livestock?" that livestock production is and will be central for the development of the food systems. They confirm that animal source foods may affect food security and nutrition positively (HLPE, 2016). However, sustainability challenges and possible contributions to food security and nutrition are different for each livestock production system. Research is required applying participatory approaches focusing on technologies, practices and metrics and institutions needed to strengthen among others resilience in diverse livestock farming systems (FAO, 2014).

The specific objective of this Nutrition Survey was to determine the most relevant causes of malnutrition in Namalu and Nadunget Sub Counties in the Karamoja Region.

Methods

An exploratory sequential mixed methods study was conducted in August 2016 comprising a total of 7 focus group discussions (FGD), 5 with mothers with children < 5 years and 2 FGD with health staff followed by a survey to assess the knowledge, attitudes and practices (KAP) of the women on infant and young child feeding practices, dietary intake, agriculture and livestock keeping practices. Two Sub Counties were selected, namely Nadunget in the district of Moroto and Namalu in Nakapiripirit district. The results were compared to results from Moroto Municipality and Nakapiripirit Town Council (TC). The nutrition survey was conducted with women 424 (of reproductive age 15 to 49) with children below two years. The villages were selected in each Sub county taking in account that all the households had the same or similar living conditions. Selection criteria for the villages in Nadunget and Namalu Sub County were high prevalence of malnutrition. This information was obtained from the local records of the Districts Health Centers. These villages were matched with villages in Moroto Municipality and Nakapiripirit Town Council based on malnutrition rates and similar infrastructure. **Table 1** provides an overview of the selected villages and number of households living in the villages.

Table 1. Overview of the selected areas for the nutrition survey

District	Sub County	Selected villages	Number of households
Moroto N = 207	**Moroto Municipality**	Campswahili chini Nakapelimen Kakoliye Kambizi Katanga	106
	Nadunget	Loodoi Kamera Kaalopwanya Naacuka Lokeriaut Kanakomol Kaipetai Kopoe Arengekeju	102
Nakapiripirit N = 217	**Nakapiripirit Town Council**	Lomu Katanga Lokona Nangoromit	109
	Namalu	Komojoj Nakiloro Nakorisat L East Angoleturof Naakwanga Kocholikokoi	107

		Loburoi Nakoyon	

The FGD with the mothers and caregivers were conducted in the local language. Interviewer and note taker underwent a training prior to the FGD by a nutrition researcher. The health professionals preferred to speak English in the FGD, because not all of them were able to speak Karamojong fluently. Each FGD had a total of 10 participants.

The quantitative data collection took place between the 23th of July and the 6th of August of 2016. There were different teams of enumerators for each sub county taking into account that participants may feel more comfortable talking to local interviewers. Two five days trainings were conducted prior to the survey in each sub county including a pre-test. Enumerators received guidelines to ensure the quality standard of the interviews. Quality control of the data was assure by team supervisors. Furthermore, each interview was double-checked by the main supervisor every day after data collection. Most of the interviews were conducted in Karamojong and some in Swahili. The interviews took place around the homestead of the selected respondent. Household were selected randomly (Gross, et al. 1997).

In addition, the supervisors made general observations. Field observations focused on the household surroundings, including cleanliness of the compound (dirt, faeces) and availability of home gardens and livestock.

The main indicators for of the following survey were Minimum Dietary Diversity for women of reproductive age (MDD-W) and the Minimum Dietary Diversity for children. The MDD-W is an indicator that is used to determinate the dimension of a women diet quality. FAO/Fanta (2016) defined the MDD-W as a dichotomous indicator, which indicates whether women between 15 and 49 years old have consumed at least five or more food items of a list of ten predefined food groups on the previous day (FAO and FHI 360, 2016). **Table 2** presents the different food groups and the local examples. The MDD-W was assessed by conducting qualitative 24 h recalls, where respondents were asked to name all foods consumed the day before. In addition, child-feeding practices were assessed using the WHO Infant and Young Child Feeding (IYCF) indicators for children aged 6–23 months: continued breastfeeding, introduction of solid, semi-solid and soft foods, and minimum dietary diversity (MDD) (WHO, 2010). These indicators look at the percentage of children meeting the recommended criteria. The Child dietary diversity (CDDS) was calculated using a 7-food-group score reflecting the consumption of seven different food groups in the past 24 hours: grains, roots and white tubers, legumes, nuts and seeds, dairy products, flesh foods (meat, poultry, fish and offal), eggs, pro-vitamin A rich foods (yellow and orange flesh roots and tubers, orange flesh fruits, and dark green leafy vegetables) and other fruits and vegetables. The minimum dietary diversity for children is defined as the proportion of children 6 - 23 months of age who receive foods from ≥ 4 food groups of the 7 recommended food groups (WHO, 2010). Mothers were asked to name all the foods their children ate in the past 24 hours and enumerators classified the information into the predetermined groups.

Table 2. Food groups and the respective Ugandan food items consumed in the Karamoja region used to assess women dietary diversity (FAO and FHI 360, 2016)

No.	Food Group	Examples from the Karamoja region
1	Grains, white roots and tubers	Posho, mandazi, porridge, spaghetti, scones (wheat buns), African cake/pan cakes, White sweet potatoes, Irish potatoes, white yams, coco yams, cassava, matooke
2	Pulses (beans, peas and lentils)	Beans, field peas, soya beans
3	Nuts and seeds	any food made from groundnuts (paste/ butter), sunflower seeds, pumpkin seeds and any other nuts and seeds
4	Dairy	Milk, cheese yoghurt or other milk products
5	Meat, poultry and fish	any kind of meat, organ meat, sea food
6	Eggs	Eggs from any kind of birds
7	Dark green leafy vegetables	Cassava leaves, pumpkin leaves, bean leaves, okra, amaranth, Irish Potato leaves, black night shade leaves, nakati, spider plant, spinach, nderema

8	Vitamin A rich fruits and vegetables	Ripe mangoes, ripe pawpaw, jack fruit (fene), guavas (mapera), apples, goose berries, wild straw berries, passion fruits, Pumpkin, carrots, orange flesh sweet potatoes
9	Other vegetables	Tomato, onion, eggplants, cabbage, green/French beans, green pepper, bamboo shoots (malewa)
10	Other fruits	Oranges, tangerines, lemons, sweet bananas, tamarins

Descriptive analysis was made including mean, median (Md), standard deviation (SD), minimum (Min) and maximum (Max) and frequencies. Differences were calculated for the different Sub counties. Correlations between variables were calculated using Pearson's correlation. Hierarchical regression analysis was conducted using the statistical software package IBM SPSS Statistics Version 24[®] (IBM Corp 2015). In all statistical tests, $p<0.05$ was considered statistically significant.

The FGD were audiotaped and transcribed using Windows Media Player 12[®]. The interviews were first transcribed into the spoken language and then translated into English by a trained transcriber according to the guidelines by Flick (2017). After translation, the transcribed files were read a second time by for accuracy and were, if necessary, corrected and anonymized. The transcripts of the FGD were analyzed with the open source software QDA Miner Lite[®] v1.4.3 a qualitative data analysis (QDA) software developed by the Provalis Research group (Provalis Research, 2015). QDA was conducted using the qualitative data content analysis approach according to Kuckartz (2014).

Results

Socio-demographic characteristics

The following table presents an overview of the socio-demographic characteristics of the study population (**Table 3**). Overall, mean age of mothers and caregivers was 26.5±6 years and for children 10.7±6.8 months. In all three Sub Counties mothers had in the mean 3 children living in their households. Most households were male headed. About 25% of the households in Namalu were female headed, in Nadunget only about 15%. The main occupation of the mothers was casual labour, i.e. washing clothes, fetching water or brewing alcohol. In Nadunget, 66.7% of the mothers reported that they sold charcoal or firewood in the municipality. In Namalu mothers worked in farming activities for bigger farmers. These activities included, weeding, harvesting and threshing maize, among others. However, only 11.6 % of the mothers were engaged in own farming (crops) activities and only few mothers (0.5 %) consider livestock keeping as main occupation. Nevertheless, about 20% of the women in Namalu and Nakapiritit mentioned crop farming as main occupation.

Table 3. *Socio-demographic characteristics of the study participants*

	Total (N= 424)	Moroto (N= 31)	Nadunget (N=102)	Nakapiri-pirit (N= 109)	Namalu (N=109)
Age of women in years [mean, SD]	27 (6)	25 (5)	28 (6)	26 (7)	27 (6)
Age of father in years [mean, SD]	31 (9)	32 (7)	35 (9)	34 (9)	34 (10)
Age of children in months [mean, SD]	10 (7)	10 (7)	10 (6)	11 (7)	12 (7)
Number of children in the household [mean, SD]	3	3	3	3	3
Min- Max	1 - 11	1- 10	1 - 7	1 - 11	1- 10
Sex of child [%]					
female	49.8	47.2	42.2	54.1	55.1
male	50.2	52.8	57.8	45.9	44.9
Household head [%]					
male	79.5	85.8	84.3	78.9	69.2
female	18.2	13.2	14.7	18.3	26.2
Marital status women [%]					
married monogamous	57	51	41	69	66

married polygamous	40	45	57	28	32
divorced/separated	5	1	1	0	0
abandoned	2	2	2	3	2
Literacy level [%]					
Able to read entirely	25.2	41.5	5.9	37.6	15.0
Able to read partly	8.7	17.9	4.9	8.3	3.7
Cannot read at all	64.9	39.6	88.2	51.4	81.3
Refused to read	0.9	0.9	0	2.8	0
Visually impaired	0.2	0	1	0	0
Educational level [%]					
University	1.4	0.9	0	3.7	0.9
Vocational training	1.9	3.8	0	2.	0.9
A-Level	1.2	0.9	0	3.7	0
O-Level	7.8	17.9	1.0	9.2	2.8
Primary (4-7)	23.1	39.6	8.8	31.2	12.6
Primary (1-3)	17.9	12.3	17.6	15.6	26.2
No school	46.7	24.5	72.5	33.9	57.0
Source of income [%]					
Selling charcoal/ firewood	21.9	0	66.7	9.2	14.0
Casual labour	39.2	19.8	18.6	41.3	75.7
Own business	23.1	43.4	13.7	19.3	15.9
Quarrying/mining	11.3	11.3	6.9	21.1	5.6
Farming of crops	11.6	0.9	3.9	20.2	20.6
Farming livestock	0.5	0	0	0.9	0
Wage employment	1.7	0	0	5.5	0.9
Vocational skills	0.7	0.9	1	0.9	0
Housewife	10.1	27.4	2.0	9.2	1.9

Literacy level of the mothers was assessed by asking them to read a sentence in either English language or Karamojong. The great majority of the mothers in Namalu and Nadunget sub-counties were not able to read at all. More than half of the women who had ever visited school in Namalu (N=46) and Nadunget (N=28), finished school at the primary level 1-3: Nadunget 64.3% and Namalu 60.9%. In Moroto (N=80) and Nakapiripirit (N=72) most of the women who had ever visited school had finished primary level 4-7 (Moroto 52.5% and Nakapiripirit 47.3%).

Agriculture

About 51% of the households (N=424) claimed to own a kitchen garden (**Table 4**). In addition, 60% of the households reported to own a farm. In the rural Sub counties, the percentage of households owning a kitchen garden and a farm was higher as in the municipality and in Nakapiripirit (TC). The main crops in the households' kitchen gardens were vegetables and staples (i.e. maize, sorghum and green leafy vegetables and pumpkins). These results were supported by field observations made at the time of the survey.

Table 4. Characteristics of the kitchen gardens and farms

	Total (N=424)	Moroto (N=106)	Nadunget (N= 102)	Nakapiripirit (N= 109)	Namalu (N=107)
Owns kitchen garden [%]	**50.5**	**23.6**	**75.5**	**37.6**	**66.4**
	(n=214)	**(n=41)**	**(n=123)**	**(n=70)**	**(n=120)**
Vegetables	77.6	80.0	76.6	85.4	73.2
Fruits	6.1	4.0	5.2	12.2	4.2
Staples	65.9	56.0	55.8	61.0	83.1
Other	15.9	24.0	22.1	12.1	8.5
Owns Farm [%]	**59.9**	**32.1**	**97.1**	**55.0**	**57.0**
	(n=254)	**(n=34)**	**(n=99)**	**(n=60)**	**(n=61)**
Vegetables	0.4	2.9	0	0	0
Fruits	11.8	8.8	8.1	23.3	8.2
Staples	99.2	97.1	100.0	100.0	98.4
Other	17.3	23.5	17.2	18.3	13.1

Child care and feeding practices

In most of the Sub counties, the majority of the 6-month-old children received complementary feeding as recommended. In Nakapiripirit only about 35% of the 6-month-old-children received complementary food. In Nadunget and some children in Nakapiripirit received complementary food before the age of 6 months. Most of the women knew in which way they could enrich porridge for their children, i.e. adding high nutrient dense vegetables, fruits, animal products and fats (Total: 70.9 %, Moroto: 84%, Nadunget: 76%, Nakapiripirit 67% and Namalu 58%).

Women's role in care was assessed by asking how many hours a day they spend away from their children. Overall, a total of 24.4% of the respondents stated they spend more than five hours a day away from their children (Namalu 32.7%, Nakapiripirit 27.8%, Nadunget 30.4% and Moroto 6.7%). Most of the women in Moroto Municipality claimed they do not worked away from home 24.8%, meaning they do not leave their children alone. Furthermore, 20.4% of all mothers stated they take their children with them if they had to leave home (Nadunget 23.5%, Nakapiripirit 17.6%, Namalu 18.7% and Moroto 21.9%). However, the number of hours children spend away from their mothers is high, 55% of all respondents said they spend between one and five hours a day away from their children. **Figure 1** presents a comparison of the amount of meals a child eats a day in relation with the hours the mothers are away from them. Most the children had 2 to 3 meals a day, despite from the hours they were left alone.
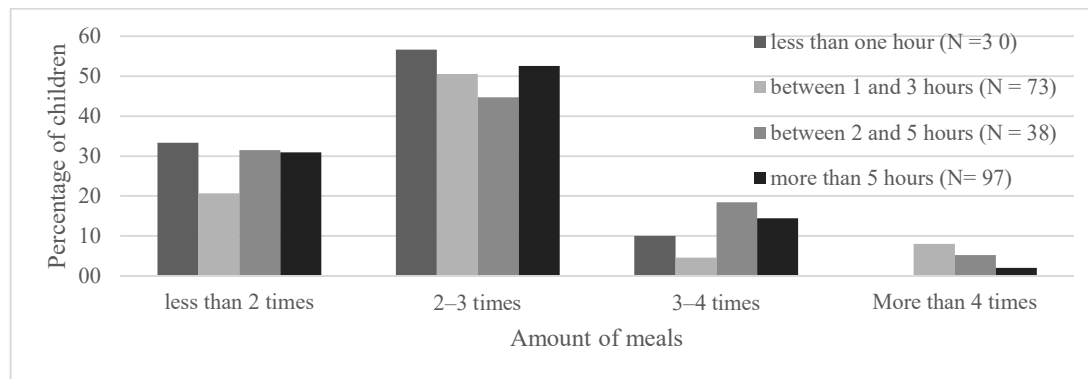

Figure 1. Amount of meals children eat in relation to the hours the mothers are away from the children

Dietary Diversity of women and children

More children than women consumed foods at the recommended minimum level of diversity. The difference ranged from 4.8% (Nadunget) to 12.1% (Moroto). The percentage of mothers and children achieving Minimum Dietary Diversity (MDD) was lowest in Nadunget (women: 3.9%, children: 8.7%) and highest in Nakapiripirit (women: 44%, children: 51%). There was no difference in the prevalence of MDD between Moroto and Namalu among women and among children. Overall, the mean number of food groups covered in the diet of the women (max=10) was 3.5 ± 1.6 (Min: 0; Max: 10). In Nadunget, the dietary diversity of women was lowest compared to the other Sub counties, achieving a maximum of only 5 food groups (Moroto: 3.5 ± 1.2; Nadunget: 2.4 ± 1.1; Nakapiripirit: 4.4 ± 1.9; Namalu 3.6 ± 1.4). The mean number of food groups covered in the diet of the children 6-23 months of age (max=7) was 2.9 ± 1.2 (Moroto: 3.1 ±1.1; Nadunget 2.4 ± 0.9; Nakapiripirit 3.3 ± 1.3; Namalu 2.8 ± 1.3).

Overall, the majority of the women and children 6-23 months of age consumed starchy staple foods, mainly plantain, maize and sorghum flour (**Figures 2 and 3**). Pulses were consumed more often in Moroto Municipality and Nakapiripirit TC compared to Nadunget and Namalu (women: Moroto 64%,
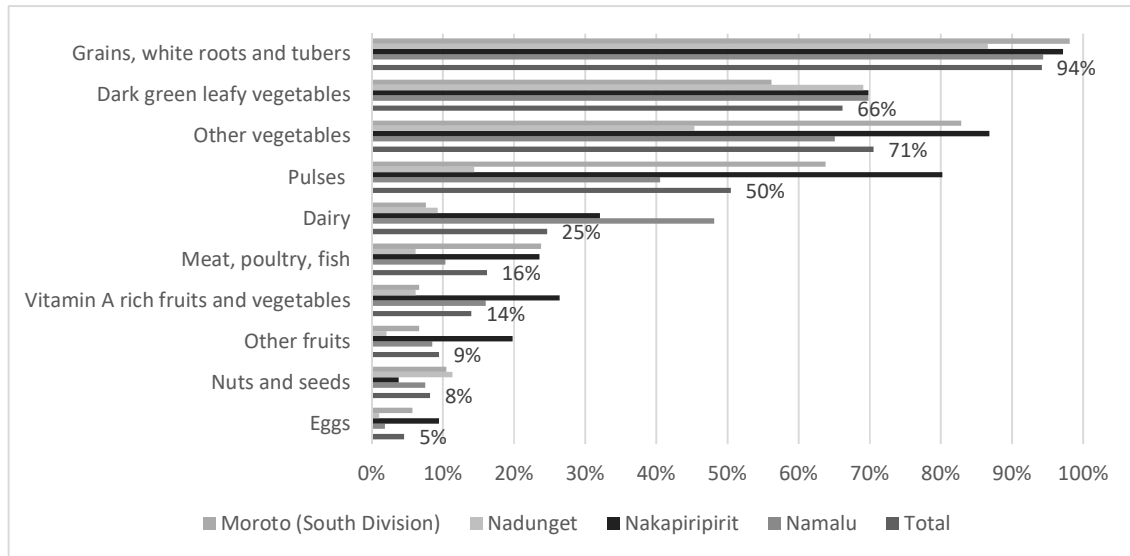
Nakapiripirit 80%, Nadunget 14% and Namal. data values have been included for „total" sample.

Figure 2. Foods consumed by women aged 15- 49 years (out of 10 different food groups)

41%; children: Moroto 44%, Nakapiripirit 73, Nadunget 14%, Namalu 41%). Other fruits, nuts and seeds and eggs were the food groups which were less consumed in the Sub counties.
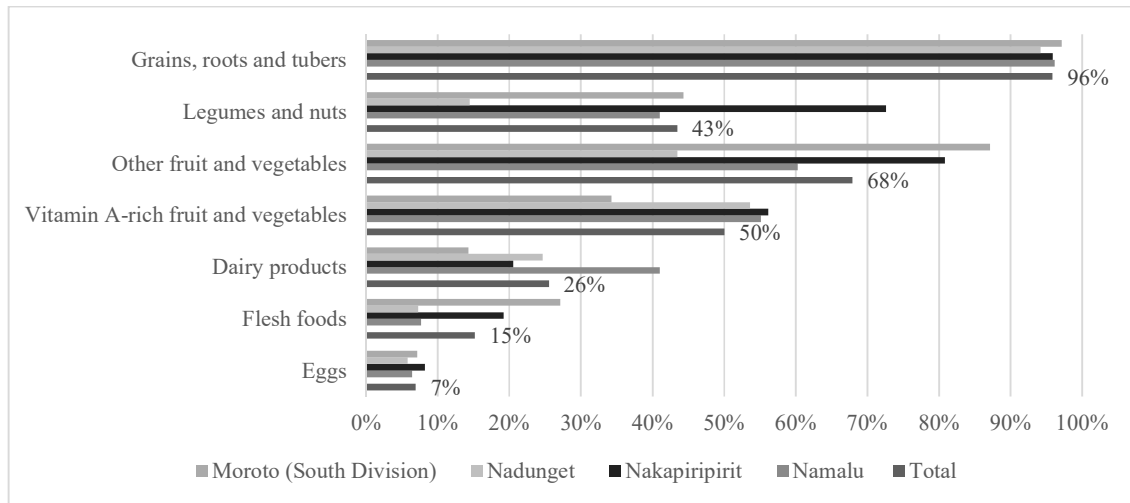
Figure 3. Foods consumed by children aged 6 to 23 months (out of 7 different food groups)

The correlation between MDD of children and ownership of livestock was 0.01, (p<0.05), thus no relationship. However, the regression analysis confirmed that livestock ownership of women might be associated with woman and child's dietary diversity under certain circumstances. **Table 4** shows the result of three regression models. Model 1 and 2 are showing that there is a significant negative relationship between owning livestock and dietary diversity of woman and children. However, if adjusted for acknowledged predictors of dietary diversity, livestock ownership is not significantly associated with dietary diversity anymore. Then, living in Nadunget is associated with a reduced

dietary diversity score of women and children, whereas if the woman lives in Nakapiripirit her dietary diversity is likely to be better compared to those living in Moroto. Never attended school and no access to a credit was associated with a reduced dietary diversity of the mother, but not of the child. The risk association changes if stratified for the location the mothers are living with their children (**Table 5**). Ownership of livestock is not associated with dietary diversity anymore. No access to credit is associated with a reduced dietary diversity of women in Moroto, and Children in Namalu only. In Nadunget, never have attended a school is negatively associated with dietary diversity of both, women and children. In Nakapiripirit there was no risk association found.

Table 5. Predictors of Woman & Child Dietary Diversity

| | **Predictors for Woman Dietary Diversity Score (WDDS) (0-10, FAO)** | | | | | | | **Predictors for Child Dietary Diversity Score (CDDS) (0-7, WHO)** | | | | | | |
Model R^2	Predictor	B	SE	Beta	*P*	95% CI lower	95% CI upper	Model R^2	B	SE	Beta	*P*	95% CI lower	95% CI upper
0.029	Owns no livestock	**-0.56**	0.16	-0.17	**<0.001**	-0.89	-0.25	*0.122*	**-0.28**	0.14	-0.11	**0.049**	-0.557	-0.001
	Age (days)	na							0.002	<0.001	0.31	<0.001	0.002	0.003
	Reference location = Moroto Municpality[1]													
2.12	Owns no livestock	**-0.48**	0.15	-0.15	**0.001**	-0.77	-0.19	*0.188*	**-0.32**	0.14	-0.12	0.025	-0.60	-0.04
	Age (days)	na							0.002	<0.001	0.30	<0.001	0.002	0.003
	Nadunget[2]	**-1.26**	0.20	-0.34	**<0.001**	-1.65	-0.87		**-0.65**	0.19	-0.22	**0.001**	-1.02	-0.27
	Nakapiripirit[3]	**0.66**	0.20	0.18	**0.001**	0.27	1.05		0.17	0.19	0.06	0.362	-0.20	0.54
	Namalu[4]	-0.16	0.20	-0.04	0.438	-0.55	0.24		**-0.38**	0.19	-0.14	**0.045**	-0.75	-0.01
	Reference location = Moroto Municpality[1]													
0.236	Owns no livestock	**-0.37**	0.15	-0.11	**0.014**	-0.657	-0.08	*0.199*	-0.26	0.14	-0.10	0.078	-0.54	0.03
	Age (days)	na												0.002
	Nadunget[2]	**-1.02**	0.22	-0.28	**<0.001**	-1.45	-0.59		**-0.55**	0.22	-0.19	**0.011**	-0.99	-0.13
	Nakapiripirit[3]	**0.71**	0.20	0.20	**0.001**	0.31	1.11		0.17	0.19	0.06	0.370	-0.21	0.56
	Namalu[4]	0.04	0.22	0.01	0.863	-0.39	0.46		-0.24	0.21	-0.08	0.256	-0.64	0.17
	School[5]	**-0.55**	0.15	-0.17	**<0.001**	-0.85	-0.25		-0.28	0.15	-0.11	0.060	-0.56	0.01
	Marry[7]	0.18	0.15	0.06	0.216	-0.11	0.47		0.17	0.14	0.07	0.233	-0.11	0.46
	Credit[8]	**-0.39**	0.14	-0.12	**0.005**	-0.67	-0.12		-0.03	0.14	-0.01	0.847	-0.29	0.24
	Child alone[9]	0.03	0.05	0.03	0.497	-0.06	0.13		0.02	0.05	0.02	0.696	-0.08	0.12

1:     1=yes, 2=no; if woman **does not** own livestock – WDDS/CDDS changed by x score units
2:     Subcounty-Dummy for Nadunget (reference group: Moroto)
3:     Subcounty-Dummy for Nakapiripirit (reference group: Moroto)
4:     Subcounty-Dummy for Namalu (reference group: Moroto)
5:     1=yes, (mother) attended school, 2=no, (mother) did not attend school; if woman **never went** to school – WDDS changed by x score units
7:     1= currently married monogamous; 2=currently married polygamous. 11 missing values on this variable! (this is why R² of model 4 can be lower than for the reference model 2); if woman was **married polygamous** - WDDS/CDDS changed by x score units
8:     1=yes, access to credit; 2=no access to credit; if household **had no access to credit** – WDDS/CDDS changed by x score units
9:     mother: 0 'does take child or does not work away from home'; 1 'less than one hour'; 2 'between 1 and 3 hours'; 3 'between 2 and 5 hours'; 4 'more than 5 hours'
    If woman **left her child alone** - WDDS/CDDS changed per left alone unit by x-score units
B= unstandardized regression coefficient (=difference in means for binary variables); SE=standard error for B; beta= standardized regression coefficient
WDDS=Women Dietary Diversity (0-10); CDDS= Child Dietary Diversity (0-7)

Table 6. Predictors of Woman & Child Dietary Diversity stratified for Sub County

		Predictors of Woman Dietary Diversity Score (WDDS)						Predictors of Child Dietary Diversity Score (CDDS)					
	Predictor	B	SE	Beta	P	95% CI lower	95% CI upper	B	SE	Beta	P	95% CI lower	95% CI upper
Moroto	Owns no livestock	-0.44	0.33	-0.13	0.195	-1.10	0.23	0.42	0.30	0.16	0.157	-0.17	1.01
	Child's Age (days)	na						0.002	0.001	0.24	0.041	<0.001	0.003
	School[5]	-0.16	0.30	-0.05	0.580	-0.75	0.42	-0.43	0.28	-0.18	0.126	-0.98	0.12
	Marry[7]	-0.07	0.26	-0.03	0.796	-0.58	0.45	0.72	0.25	0.34	0.006	0.21	1.22
	Credit[8]	**-0.66**	0.26	-0.25	**0.014**	-1.18	-0.14	-0.08	0.25	-0.04	0.760	-0.58	0.42
	Child alone[9]	0.07	0.11	0.07	0.491	-0.14	0.03	0.21	0.09	0.26	0.030	0.02	0.39
	R²	*0.110*						*0.274*					
Nadunget	Owns no livestock[1]	0.11	0.23	0.05	0.630	-0.35	0.57	-0.02	0.25	-0.01	0.937	-0.52	0.48
	Child's Age (days)	na						0.001	0.001	0.15	0.269	-0.001	0.003
	School[5]	**-0.74**	0.26	-0.31	**0.005**	-1.25	-0.23	**-0.75**	0.27	-0.35	**0.007**	-1.28	-0.22
	Marry[7]	0.32	0.23	0.15	0.176	-0.14	0.78	0.20	0.24	0.11	0.392	-0.27	0.68
	Credit[8]	-0.04	0.22	-0.02	0.846	-0.48	0.40	-0.21	0.23	-0.11	0.359	-0.67	0.25
	Child alone[9]	-0.03	0.07	-0.05	0.655	-0.17	0.11	-0.06	0.09	-0.09	0.498	-0.24	0.12
	R²	*0.085*						*0.168*					
Nakapiripirit	Owns no livestock[1]	-0.73	0.35	-0.19	0.038	-1.41	-0.04	-0.38	0.32	-0.14	0.235	-1.02	0.26
	Child's Age (days)	na						0.003	0.001	0.38	0.004	0.001	0.01
	School[5]	**-1.33**	0.38	-0.33	**0.001**	-2.08	-0.57	-0.27	0.34	-0.09	0.439	-0.95	0.42
	Marry[7]	0.45	0.38	0.11	0.240	-0.30	1.20	-0.37	0.33	-0.13	0.261	-1.03	0.28
	Credit[8]	-0.53	0.35	-0.14	0.136	-1.22	0.17	-0.24	0.32	-0.09	0.460	-0.88	0.40
	Child alone[9]	0.001	0.12	0.001	0.992	-0.24	0.24	-0.03	0.12	-0.03	0.837	-0.27	0.22
	R²	*0.211*						*0.230*					
Namalu	Owns no livestock[1]	-0.38	0.26	-0.14	0.149	-0.90	0.14	-0.58	0.27	-0.22	0.036	-1.11	-0.04
	Child's Age (days)	na						0.002	0.001	0.31	0.008	0.001	0.004
	School[5]	-0.01	0.27	-0.004	0.972	-0.54	0.52	-0.04	0.27	-0.01	0.893	-0.58	0.51
	Marry[7]	0.08	0.29	0.03	0.770	-0.49	0.66	0.28	0.31	0.10	0.370	-0.34	0.91
	Credit[8]	-0.11	0.27	-0.04	0.673	-0.64	0.41	**0.54**	0.27	0.21	**0.051**	-0.002	1.07
	Child alone[9]	0.14	0.09	0.16	0.121	-0.04	0.33	0.02	0.10	0.02	0.821	-0.18	0.23
	R²	*0.047*						*0.239*					

1:     1=yes, 2=no; if woman **does not** own livestock – WDDS/CDDS changed by x score units

5:     1=yes, (mother) attended school, 2=no, (mother) did not attend school; if woman **never went** to school – WDDS changed by x score units

7:     1= currently married monogamous; 2=currently married polygamous. 11 missing values on this variable! (this is why R² of model 4 can be lower than for the reference model 2); if woman was **married polygamous** - WDDS/CDDS changed by x score units

8:     1=yes, access to credit; 2=no access to credit; if household **had no access to credit** – WDDS/CDDS changed by x score units

9:     mother: 0 'does take child or does not work away from home'; 1 'less than one hour'; 2 'between 1 and 3 hours'; 3 'between 2 and 5 hours'; 4 'more than 5 hours'; If woman **left her child alone** - WDDS/CDDS changed per left alone unit by x-score units

B= unstandardized regression coefficient (=difference in means for binary variables); SE=standard error for B; beta= standardised regression coefficient

WDDS=Women Dietary Diversity (0-10); CDDS= Child Dietary Diversity (0-7)

Discussion and Recommendations

The percentage of children achieving MDD was only 32.9 % (Moroto: 35.7; Nadunget: 8.7; Nakapiripirit: 50.6; Namalu: 34.1). This results are in accordance with the Ugandan demographic health survey, were only 30 % of the Ugandan children aged 6 to 23 moths achieved minimum dietary diversity (UBOS and ICF, 2018).

It is still important to investigate in the specific causes of food insecurity in Karamoja (maize and sorghum dependence, low income for women, crop diversity, availability of qualitative food in the market, knowledge to buy adequate food etc.). Through improved access to diverse nutritious foods on the families' farms and kitchen gardens, women may be able to improve the intake of those if such foods are available, affordable, and convenient. However, recent studies showed that although local government promote sedentary agriculture and there is an increase in the cropland area in the region there is no evidence of an increase in overall crop production or food security. Due to lack of resources for inputs (i.e., seeds and labor), cultivated fields remain very small in size and over 55% of once cultivated land is left unplanted (Nakalembe, Dempewolf, & Justice, 2017). Agriculture is a key sector when it comes to improved nutrition, however is important to link nutrition and agriculture to achieve nutrition security.

Ownership of kitchen gardens was high for Nadunget and Namalu sub counties. Overall, ownership of kitchen gardens was about 50%. Most often, respondents reported to plant vegetables (77.6%) and staples (65.9%). Fruits were not usually cultivated by the mothers. Yet, 15% of the women did not had any crops planted in the kitchen garden. Additionally, observations showed that crop diversity were very low and that in some of the kitchen gardens no crops had been planted. In addition, mothers were aware of healthy nutrition practices and ways to improve the nutrition of their children. However, results of both DDS for women and children reveal that diversification of foods consumed still remains a challenge. These results confirm that there is still a gap between knowledge and practice of good nutrition habits. Promotion of home gardens should be continued, as nutrition-sensitive agricultural programs are proven to increase food and nutrition security (Bhutta et al., 2008). Still, they have been proofed to be more sustainable when they include nutrition and health behavior change communication and women empowerment (Ruel, et al., 2018). Nutrition education programs, that encourage households to grow vegetables for home consumption as well as for income generation, will contribute to the diversification of the daily diet and probably increase food security (Waswa, et al., 2015).

The effects of women's work in agriculture on childcare and child feeding practices are well researched. Women engaged in agricultural practices often face time management challenges, heavy and prolonged female workloads in agriculture often stand against adequate care for young children (Gillespie, et al., 2012). Most of the surveyed women stated to leave their children alone or in care of younger siblings when they must work. Insufficient care leads to inadequate feeding practices. Mothers will be forced to stop exclusive breastfeeding and introduce other foods than breastmilk at a young age. Child care opportunities need to be explored as many women must start or continue working when the child is still very young in order to create income for the family. It is also recommended to impart knowledge about infant and young child feeding practices to grandmothers and fathers taking care of children in absence of the mother. Furthermore, employers should work together with women self-help groups in order to create and provide adequate child care (i.e. day care) for young infants. In addition, it is important to take into account socio-cultural practices in the region, since they may influence food and nutrition security, exposing women and children to the risk of malnutrition and associated consequences (Muggaga et al., 2017; Olum et al., 2017). Future strategies should include improvement of child caring system and reinforcement of nutrition education in a participatory learning manner to close the gap between knowledge and practice.

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Aknowlegments