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Research Paper

Livestock keeping and consumption in improving nutritional status of 6 to 59 months old children in Kasulu rural households

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Abstract. Livestock keeping and consumption of Animal Source Foods (ASF) in Kasulu rural households is relatively poor, thus posing a higher risk of under-five children malnutrition. Therefore, the study examined if livestock keeping and consumption contributes to nutritional status among 6 to 59 months old children. A cross-sectional study design was employed involving 413 households using a semi-structured questionnaire to obtain socio-demographic data using a standardized procedure. The study found a strong relationship between livestock ownership, Animal Source Food consumption, and improved nutritional status. Chicken (p = 0.000), goat (p = 0.025), sheep (p = 0.026), and duck (p = 0.000) showed a strong association in terms of consumption. Animals like chicken (p = 0.011), and pigeons (p = 0.000) consumption showed a strong association with being underweight. Pigeon (p = 0.000) consumption showed a strong association with wasting and no animal consumption showed a strong association with stunting. Binary regression showed a higher odd ratio with goat (OR = 2.576, 95%CI: 0.909-4.076) and (OR = 2.915, 95%CI: 0.334-2.055) led to stunting and underweight respectively. The study concludes that livestock keeping and Animal Source Food consumption improve children's nutritional status and households in the study area. Therefore Kasulu rural households are encouraged to keep more livestock and consume regularly animal-sourced foods.

Keywords: Contribution, animal source food, under five, Kasulu rural households.

INTRODUCTION

Globally, researchers have acknowledge the significant role played by livestock in reduction of malnutrition among under-5 children (Banda and Tanganyika, 2021; Chen *et al*., 2021). For that case, there is a high demand for livestock production worldwide (Bundala *et al*., 2020). Such trend is motivated by the fact that as human population increases, demands for livestock products, income and ASF also increase at the global level (NBS, 2013; Zezza and Nsiima, 2013; URT, 2021). Livestock keeping contributes significantly to national and household income and food security, necessary for improved nutritional status of children under the age of five (Pauw and Thurlow, 2011). According to Rwekaza *et al.* (2018), livestock is a good source of incomes and high-quality food for nutritional status.

In Tanzania, like other African countries, livestock keeping is among the key activities, and Tanzania is the third producer of livestock after Sudan and Ethiopia in Africa (NBS, 2013). For Robinson *et al.* (2014) cattle, goats, sheep, pigs, chicken, ducks, turkeys, rabbits and donkeys are the livestock that are mostly kept in large quantities in Tanzania. About 40% of farm households retain animals, with only 2% working as pure livestock farmers and the remaining 38% working as combined

livestock and crop farmers (Haileselassie *et al.*, 2020). Small holder dairy farming is growing at a rate of about 6% yearly with an estimation of about 190 000 known livestock keepers in the country (Swai and Karimuribo, 2021).

Although livestock keeping plays significant roles in providing meat, milk and milk products, eggs, fur and manure (Khan *et al.*, 2021), it is reported that in Tanzania the consumption of ASFs is still low (Goromela *et al.*, 2017; Bundala *et al.*, 2020). Such scenario of ASF low consumption cannot be taken as an afterthought in this century when every country is struggling to improve children's nutritional status which has direct relationship with child growth and good performance in education. ASF supply high-quality protein and vital micronutrients in the human diet which are important for children's health and development (Schonfeldt and Hall, 2013; Smil, 2014; Godfray *et al.*, 2018; Raiten *et al*., 2020). Thus, there is great relationship between ASF consumption and children's improved development, cognitive function, physical activity levels, educational achievement, pregnancy outcome, and reduced morbidity (Darapheak *et al*., 2013; Margesa *et al*., 2014; Zhang *et al*., 2016; Mekurie and Mekonnen, 2018).

On the contrary, a study by UNICEF (2020) shows that many children under the age of five continue to be malnourished in about a quarter of the world. In Tanzania, despite the efforts made in eliminating the problem of malnutrition among children between 2014 and 2018, yet, the rate of under nutrition, notably stunting, remained relatively high, which is shown by existing data that about three million children under the age of five were still stunted (TNNS, 2016, 2018); whereby, regions leading in high stunting are Ruvuma, Iringa, Rukwa, Kigoma, Njombe and Songwe with more than 40% of stunting. Several regions are making progress in reducing malnutrition especially stunting from 2014 to 2018. Regions like Dodoma, Morogoro, Pwani, Lindi, Tabora, Kagera, Mwanza and Katavi are reported to make good progress.

It is agreed that different types of food obtained from animal products, number and frequency of feeding of children are important in providing important micronutrients for child growth and development. This means that optimal feeding practices will always provide appropriate children nutritional status (Khan *et al.*, 2017). However, studies by Mbwana *et al.* (2016) and Fadare *et al.* (2019) show that parents' food choices in terms of quality and quantity and limited health services contribute to the persistence of malnutrition among children under 6 to 59 months.

Thus, taking into consideration that, livestock keeping apart from other benefits, produce ASF that are rich in micronutrient supplementation that contributes to diversified diet (Margesa *et al*., 2014; Mekurie and Mekonnen, 2018), and that about 85% of the majority of Kigoma population is mostly involved in subsistence agriculture (Peter, 2015; El Chami *et al.*, 2020; USAID, 2021) because the region has favourable and conducive climatic condition for keeping animals and agriculture (FAO, 2021). Understanding to what extent livestock keeping contributes to the improvement of children's nutritional status in this region was important in order to develop empirical evidence. As Tshiya and Magoha (2020) confirmed that there are mixed results, and it is debated whether there is a significant correlation between livestock ownership and the nutritional status of the children or not. Therefore, this study aimed to determine whether there is an association between livestock keeping and the malnutrition levels of 6 to 59 months children in households of rural parts of Kasulu District. Specifically, this study was conducted to determine livestock keeping and consumption (type, number, frequency) in improving the nutritional status of 6 t0 59 months old children in Kasulu Rural households in Kigoma. Results from this study inform policy makers and other development stakeholders on the status of livestock keeping in terms of types of animals kept, number of animals kept per household, and purpose of keeping them as well as the frequency of consuming ASF in each household involved in this study.

METHODOLOGY

Study area

The study was conducted in five wards of Kasulu rural district which were Rungwe-Mpya, Nyachenda, Nyamyunsi, Shunguliba and Kurugongo. The district is located about 1,211 km from Dar es Salaam, about 768 km from Dodoma, and about 95 km from Kigoma Kigoma Municipality (URT, 2021). The region was selected because the majority of residents in the region engage themselves in mixed farming, and there is a remarkable shift of the Sukuma people to the place with their herds of livestock, leading to an increased population of livestock in the study area.

Study design

A cross-sectional study design was employed whereby a simple random sampling technique was used to select households involved in the study from five wards of three divisions which were chosen purposively. A sample was estimated by using the Martinez–Millaina *et al.* (2018) formula, based on the prevalence of stunting in Kigoma which is 42.3% (TNNS, 2018). A total of 413 respondents were involved in the study. The formula is described as follows:

$n = [z^2 * p*(1-p)/ d^2]$

Where:
n = required sample.

z = Standard normal deviate, set at 1.96, corresponding to 95% level of confidence.
p = Proportion of the target population estimated to have particular characteristics.
q = Is obtained by (1-p).
d2 = Degree of accuracy desired, set at 5% (standard value at 0.05).

Therefore, $1.96^2 \times [(0.423 \times 0.577)/0.05^2] = 375.049$. In addition, 10% attrition = 37.5049. Taking into account the attrition rate of 10%, the reasonable sample size for this study was 413 (i.e., 375.049 + 37.509). A total of 413 households were selected. Standard normal distribution of 0.95 (95%) and an absolute error of 0.05 (5%) were used to obtain the sample size of 413 mothers or care givers and their children aged 6 to 59 months. Households were considered to keep livestock if they had one or more ponds of fish, cattle, chicken, pigeon, turkey, pig, goat, sheep, rabbits, guinea pigs and ducks. Likewise, consumption of ASF was based on the purpose of each category of livestock kept from each respective ward sampled.

Sampling procedure

Five wards from three divisions with a high prevalence of wasting, stunting, and underweight were selected to participate. The selection criteria included, (i) located in one of the three divisions representatives of the geographical variability of the district, South part Rungwe Mpya ward, East south Shunguliba, East east south Kurugongo, Northeast Nyamyunsi, and north –northeast Nyachenda. (ii) In each division villages representing the ward in rural settings were selected. In each division, one ward with a minimum of one village and 70 to 95 households were sampled. The selected communities included Makere, Buhoro, and Heru-chini divisions. In each community, one ward participated after they agreed to participate in the study after approval from local and university authorities and these were Rungwe-Mpya (n = 90, Nyachenda (n = 88), Nyamyunsi (n = 73), Shunguliba (84), and Kurugongo (n = 78).

Mothers/caretakers from each of the five wards (n=413) participated in the study. Three children with nutrition edema were eliminated from the study. Children with ages below 6 months and above 59 months and who were seriously sick were also eliminated. Because were not eligible candidates for the study. Data were analyzed according to socio-demographic characteristics, livestock keeping, and purpose.

Data collection and instruments

In order to gather information on the number of animals kept and their intended use in relation to under nutrition, the study employed a standardized series of questionnaires. Measures of wasting, stunting, and underweight were collected by measuring, weight and height/length, height/length and age, and weight and age respectively.

Ethical considerations

The permission to carry out the research was granted by Sokoine University of Agriculture (Ref. SUA/ADM/R.1/8/657) and by the Regional Administrative Secretary (RAS) Kigoma. Informed consent was obtained from parents who were willing to participate in this study and were assured that all information will be confidentially kept.

Data analysis

Data from the questionnaire were coded, entered into the Statistical Package for the Social Sciences (SPSS) software IBM version 20 and analysed. Frequencies and percentages were computed. Chi-squared tests were performed to identify relationships between the consumption of animal-source foods and the wasting, stunting and underweight status of children aged 6 to 59 months. Wasting, stunting, and underweight was assessed using "binary logistic regression in relation to animal source foods consumption on 6 to 59-month-old children at the $p \leq 0.05$ level of significance."

Socio-demographic characteristics

Results show that nearly more than half of the respondents were between 19-34 years of age from all wards. More than three-quarters of the mothers were married in all wards, and the majority 84 (93.3%) of caretakers had completed only standard seven levels of education. More than half of all mothers and fathers were mere peasants (Table 1).

Types of livestock kept and purpose

Table 2 shows that more than 75% of all respondents were not keeping livestock, and among those keeping livestock chicken was the leading animal kept by 13.5%; the chickens were kept for food and sale. Other animals were kept by less than 2.0% of the respondents. ASF with a positive association in improving nutritional status was the consumption of chickens ($p = 0.000$), goats ($p = 0.025$), sheep ($p = 0.026$) and ducks ($p = 0.000$).

Types of animals kept and purpose in relation to child nutritional status

Table 1. Socio-demographic characteristics of respondents from Kasulu rural households (n = 413).

Socio-demographic characteristics		Households				
		Rungwe Mpya (n = 90)	Nyachenda (n = 88)	Nyamyunsi (n = 73)	Shunguliba (n = 84)	Kurugongo (n = 78)
		n(%)	n(%)	n(%)	n(%)	n(%)
Parents' sex	Male	72(80.0)	76(86.4)	70(95.9)	81(96.4)	71((91.0)
	Female	18(20.0)	12(13.6)	3(4.1)	3(3.6)	7(9.0)
Mothers' age	10-18	53(58.9)	4(4.6)	0(0.0)	1(1.2)	0(0.0)
	19-34	37(41.1)	64(72.7)	40(54.8)	33(39.3)	61(77.8)
	35-59	0(0.0)	20(22.7	28(38.7)	29(34.5)	8(2.1)
	60+	0(0.0)	0(0.0)	5(6.5)	8(9.5)	6(1.5)
Maternal marital status	Single	19(21.1)	10(11.4)	14(19.2)	12(14.3)	12(15.4)
	Married	71(78.9)	78(88.6)	59(80.8)	72(85.7)	66(84.6)
Maternal education level	Non-formal	6(6.7)	29(33.0)	26(35.6)	39(46.2)	15(19.2)
	Standard7	84(93.3)	59(67.0)	47(64.4)	45(53.8)	63(80.8)
Mother's occupation	Housewife /peasants	83(92.3)	86(97.8)	72(98.6)	84(100.0)	77(98.7)
	Entrepreneur	3(3.3)	1(1.1)	0(0.0)	0(0.0)	0(0.0)
	None	4(4.4)	1(1.1)	1(1.4)	0(0.0)	1(1.3)
Father's occupation	Peasant	88(97.8)	88(100.0)	47(64.4)	65(77.4)	71(91.0)
	Entrepreneur	1(1.1)	0(0.0)	26(35.6)	19(22.6)	7(9.0)
	None	1(1.1)	0(0.0)	0(0.0)	0(0.0)	0(0.0)

Table 3 shows different types of livestock kept and their purposes in relation to under nutrition. The results show that low consumption of pigeons led to wasting (p = 0.000), and low consumption of chicken (p = 0.011) and pigeons (p = 0.000) led to being underweight. But no animal source food was found to be associated with stunting.

Odds ratios to identify factors associated with under nutrition

The results in Table 4 show that the factors associated with a higher risk of causing stunting and being underweight were goat (OR = 2.576, 95% CI: 0.909-4.076) and (OR = 2.915, 95% CI: 0.334-2.055) respectively. No higher risk was shown for wasting status.

Odds ratios of under-nutrition on mothers and child factors

Table 5 shows the factors which posed a high risk of wasting, stunting, and being underweight. Factors associated with child wasting were ward/location (OR = 2.621, 95% CI: 0.959 to -7.167), and mother's age (OR = 2.382, 95% CI: 0.305 to 8.605). The risk of causing stunting was child growth monitoring (OR = 4.367, 95% CI: 0.446 to 42.748). The risk factor in posing child underweight was child growth monitoring (OR = 4.389, 95% CI: 0.598 to 32.207).

DISCUSSION

The association between livestock rearing, ASF intake, and children's stunting, wasting, and underweight status in Kasulu Kigoma was reported in this study, one of the few descriptive analyses that did so. The ownership of these animals was found to increase livestock keeping and consumption. Furthermore, it was discovered that in all wards, owning and consuming livestock was not always linked to an improvement in children's nutritional status. This underlines the need to take into account a variety of different geographical characteristics to encourage the maintenance of livestock and the consumption of ASF to decrease child stunting, wasting, and underweight.

In Kigoma, there were very few differences in livestock ownership and keeping. Within the region, chicken is kept by at least more people. The investigation did not discover any association between wasting and ASF consumption. Goat intake was only found to have a stronger correlation with stunting and being underweight. However, this study was comparable to Hetherington *et al*.'s (2017) in that it

Table 2. Types of animals kept and purpose.

Variable		Rungwe Mpya (n = 90)	Nyachenda (n = 88)	Nyamyunsi (n = 73)	Shunguliba (n = 84)	Kurugongo (n = 78)	Total (N=413)	P-value
Animals	**Purpose**	**n(%)**	**n(%)**	**n(%)**	**n(%)**	**n(%)**	**n(%)**	**P ≤ 0.05**
Fish	Food	1(1.3)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.2)	0.455
	No	89(98.4)	88(100.0)	73(100.0)	84(100.0)	78(100.0)	412(99.8)	
Cow	Food	0(0.0)	0(0.0)	1(1.8)	0(0.0)	0(0.0)	1(0.2)	0.099
	Sale	0(0.0)	0(0.0)	4(5.5)	3(3.6)	0(0.0)	7(1.7)	
	No	84(100.0)	88(100.0)	68(92.7)	81(96.4)	78(100.0)	405(98.1)	
Chicken	Food	1(1.1)	0(0.0)	3(4.1)	0(0.0)	0(0.0)	12(2.9)	0.000
	Food/sale	17(18.9)	6(6.8)	1(1.4)	0(0.0)	0(0.0)	17(5.7)	
	Sale	17(18.9)	13(14.8)	15(20.5)	7(8.3)	3(3.8)	39(13.1)	
	Other	1(1.1)	0(0..0)	0(0.0)	0(0.0)	0(0.0)	1(0.3)	
	No	54(60.0)	69(78.4)	54(74.0)	77(91.7)	75(96.2)	237(79.8)	
Pigeon	Food	0(0.0)	0(0.0)	1(1.4)	0(0.0)	1(1.3)	3(0.7)	0.226
	Sale	0(0.)	0(0.0)	4(5.5)	4(4.8)	1(1.3)	10(2.4)	
	No	90(100.0)	88(100.0)	68(93.1)	80(95.2)	76(97.4)	400(96.9)	
Turkey	Dung	4(4.4)	2(2.3)	0(0.0)	0(0.0)	0(0.0)	5(1.2)	0.175
	Sale	1(1.1)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.2)	
	No	85(94.4)	86(97.7)	73(100.0)	84(100.0)	78(100.0)	407(98.6)	
Pig	Food	4(4.4)	0(0.0)	1(1.4)	0(0.0)	0(0.0)	5(1.2)	0.169
	Sale	1(1.1)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.3)	
	No	85(94.4)	88(100.0)	72(98.6)	84(100.0)	78(100.0)	407(98.5)	
Goat	Food	10(11.1)	9(10.2)	0(0.0)	0(0.0)	0(0.0)	18(4.4)	0.025
	Sale	3(3.3)	3(3.4)	4(5.5)	4(4.8)	3(3.9)	17(4.1)	
	Dung	1(1.1)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	1(0.2)	
	No	76(84.5)	76(86.4)	69(94.5)	80(95.2)	75(96.1)	377(91.3)	
Sheep	Food	4(4.4)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	4(1.0)	0.026
	No	86(95.6)	88(100.0)	73(100.0)	84(100.0)	78(100.0)	409(99.0)	
Hire	No	90(100.0)	88(100.0)	73(100.0)	84(100.0)	78(100.0)	413(100.0)	
Guinea pigs	Sale	3(3.3)	0(0.0)	0(0.0)	0(0.0)	0(0.0)	3(0.7)	0.119
	No	87(96.7)	88(100.0)	73(100.0)	84(100.0)	78(100.0)	410(99.3)	
Duck	Sale	0(0.0)	10(11.4)	1(1.4)	0(0.0)	0(0.0)	11(2.7)	0.000
	No	90(100.0)	78(88.6)	72(98.6)	84(100.0)	78(100.0)	402(97.3)	

Table 3. Types of animals kept and purpose in relation to child nutritional status.

Types of animal	Purpose	Wasting		Stunting		Underweight	
		n(%)	*P*-value	n(%)	*p*-value	n(%)	*p*-value
Fish	Food	0(0.0)	0.999	0(0.0)	0.684	0(0.0)	0.969
	No	21(5.1)		179(43.3)		83(20.1)	
Cow	Food	0(0.0)	1.000	0(0.0)	0.491	0(0.0)	0.958
	No	22(5.3)		248(60.0)		81(19.6)	
Chicken	Food	0(0.0)	0.996	14(3.4)	0.341	14(3.4)	0.011
	Sale	0(0.0)		18(4.4)		91(22.0)	
	No	26(6.3)		350(84.8)		86(20.8)	
Pigeon	Food	0(0.0)	0.000	21(5.0)	0.675	0(0.0)	0.000
	Sale	118(28.6)		36(8.7)		3(42.9)	
	No	19(4.5)		248(60.0)		54(18.2)	
Turkey	Dung	0(0.0)	1.000	2(50.0)	0.583	1(25.0)	0.371
	Sale	0(0.0)		1(100.0)		1(100.0)	
	No	15(5.2)		125(42.8)		55(18.8)	
Pig	Food	0(0.0)	1.000	1(25.0)	0.809	1(25.0)	0.992
	Sale	0(0.0)		0(0.0)		0(0.0)	
	No	15(5.2)		127(43.5)		16(5.5)	
Goat	Food	0(0.0)	0.961	4(30.8)	0.125	0(0.0)	0.906
	Sale	2(16.6)		8(66.7)		3(25.0)	
	Dung	0(0.0)		1(100.0)		0(0.0)	
	No	13(4.8)		355(86.0)		54(19.9)	
Sheep	Food	0(0.0)	0.994	2(66.6)	0.675	2(66.7)	0.082
	No	15(5.1)		126(44.8)		55(18.7)	
Hire	No	15(5.0)		178(43.0)		57(19.2)	
Guinea pigs	Sale	0(0.0)	0.997	0(0.0)	0.466	0(0.0)	0.919
	No	15(5.1)		253(85.8)		57(19.3)	
Duck	Sale	0(0.0)	0.964	4(50.0)	0.671	0(0.0)	0.565
	No	15(5.2)		124(43.9)		57(19.2)	

found no evidence of a consistent relationship between ASF consumption and a decrease in stunting, wasting, or underweight in any of the wards.

Prevalence of wasting and consumption of animal-source foods

The prevalence of wasting was not associated with families that did not consume ASF and those that kept livestock, it was higher above the national and regional level of 5.9% (TNNS, 2018).

Different reasons or factors behind the low consumption of ASFs are reported in the literature. For example, Bellmann *et al.* (2016) and Wang *et al.* (2021) did a study in urban China and found that marine food was much traded worldwide but lowly consumed due to its high price while Farchi *et al.* (2017) found consumers' perceptions of the dangers connected with other foods and other factors such as financial, psychological performance, and social repercussions of their point-of-purchase and decisions contributing to low consumption. A recent study done in Kenya reported that low consumption of food contributed to the poverty of rural people (Otiang *et al*., 2022).

Table 4. Odds ratios to identify factors associated with under nutrition.

Types of animal	Odds ratios					
	Wasting	95%CI	Stunting	95%CI	Underweight	95%CI
Ward	0.737	0.245-2.213	0.984	0.616-1.572	1.015	0.563-1.828
Fish	1.053	0.497-2.511	1.762	0.759-2.010	1.238	0.442-1.415
Cow (beef)	1.054	0.198-1.761	0.499	0.901-2.625	1.243	0.552-2.012
Chicken	0.855	0.738-0.991	1.018	0.909-1.140	0.921	0.814-1.042
Pigeon	0.141	0.095-2.193	0.752	0.179-1.858	0.383	0.209-3.012
Turkey	1.054	0.481-2.867	0.499	0.500-1.326	0.348	0.504-1.638
Pig (pork)	0.982	0.967-0.998	0.997	0.967-0.998	1.001	0.963-1.040
Goat	0.577	0.184-1.471	2.576	0.909-4.076	2.915	0.334-2.055
Sheep	1.054	0.283-2.176	0.375	0.575-1.987	0.115	0.543-2.582
Guinea pigs	0.993	0.983-1.003	0.988	0.971-1.005	0.992	0.980-1.003
Duck	1.055	0.984-1.6003	0.752	0.973-1.004	1.246	0.016-4.273

Table 5. Odds ratios of under-nutrition on mothers and child factors odd ratios.

Variable	Odd ratios					
	Wasting	95%CI	Stunting	95%CI	Underweight	95%CI
Ward	**2.621**	**0.959-7.167**	1.367	0.878-2.129	0.766	0.441-1.329
Mother's age (year)	**2.382**	**0.305-8.605**	1.293	0.662-2.527	0.55	0.262-1.155
Mother's level of education	0.357	0.046-2.782	1.371	0.738-2.547	0.663	0.281-1.564
Mother's occupation	0.948	0.948-0.974	0.425	0.084-2.142	0.581	0.070-4.821
Monthly income	0.554	0.192-1.598	1.214	0.765-1.925	1.067	0.600-1.900
Childs Sex	1.035	0.601-1.781	0.906	0.583-1.408	1.035	0.601-1781
Birth order	1.351	0.510-3.578	0.505	0.323-0.789	0.750	0.436-1.290
Child Immunization	0.944	0.919-0.969	0.561	0.509-0.618	0.794	0.751-0.840
Birth weight	0.941	0.118-7.523	1.113	0.413-3.001	1.983	0.442-8.897
Growth monitoring	0.948	0.918-0.980	**4.367**	**0.446-42.748**	**4.389**	**0.598-32.207**
Household head	0.578	0.074-4.550	1.169	0.560-2.439	0.578	0.431-3.458

Other recent studies have shown that low keeping and consumption of ASF was associated with poor income and social perception of these types of food (Otiang *et al.*, 2022).

Other factors that contributed to children wasting were the mother's age and location. These findings are consistent with the results of a previous study done in Brazil which showed that wasting was associated with low mother age, being explained by low maternal education and possible cesarean section delivery, and poor sociocultural factors (Ramos *et al.*, 2015). Different reasons for child wasting were explained by low socioeconomic status and higher family size that led to some children lacking enough food as reported previously in Ethiopia when Carruth and Mendenhall studied food insecurity and its implication (Carruth and Mendenhall, 2019; Verma and Prasad, 2021). This is consistent with findings of a study done in African countries, including Tanzania, by which it was found that the possible causes of this could be the mother's age and income being the commonest significant factors for wasting (Verma and Prasad, 2021).

Another factor that contributed to child wasting was the location of the households themselves. A study in South Africa by Chakona and Shackleton (2018), found that children's nutritional status, which is linked to socioeconomic level and household food security, is significantly influenced by agroecological potential. Different types of malnutrition in children can be caused by reliance on food purchases, restrictions on household income, access to land, and food. This is in line with a study done in the urban area in the street of Sylhet division in Bangladesh which found that the most people in need, the poorest socio-demographic group, or children in the urban area, small size children at birth, mothers with no education require urgent attention from the policymakers (Hossain *et al.*, 2020).

Generally, the lack of improved water sources, small maternal stature and maternal illiteracy could all be additional contributing factors (Verma and Prasad, 2021).

Prevalence of stunting

The study found greater stunting percentages in all households, which were caused by low or non-consumption of ASF in the study area. The stunting percentage was greater, notably in households that did not eat ASFs, where it was 43.3%, above the national percentage of 31% and beyond the Kigoma Region's value of 42.3% (TNNS, 2018). Results from the binary logistic model revealed that low consumption of goat meat was significantly associated with stunting with higher odds ratios. This is consistent with the findings of a study by Kaimila in Malawi among 12 to 36 months aged children (Kaimila *et al*., 2019) which found that poor nutrition contributed to a lack of access to different ASF. Different scholars have shown the benefits of consuming goat meat, and this study is consistent with the findings by Mazhangara *et al*. (2019) and Pophiwa *et al.* (2020) which showed the benefits of goats in improving diet and nutrition. Poor consumption of ASF was contributed to by myths and cultural values of some people as reported by Sapir-Hen (2019) in Israel. Low goat consumption is caused by the higher price and sacrificial beliefs as reported previously from Israel's ancient times (Ekroth, 2014)

Other factors identified by other studies were poor sanitation and lack of access to clean drinking water, lack of proper healthcare for children and their mothers added risk of stunting. Inadequate psychosocial stimulation and/or parent-infant bonding also were other factors. The importance of these ASFs is well known in the literature, for example, reasons behind low consumption of ASFs include but are not limited to high cost (Pieniak *et al.*, 2011; Bellnann *et al*., 2016; Wang *et al*., 2021). Frequent consumption of goat meat can reduce stunting in under five children.

Another strong reason for child stunting was poor child growth monitoring as was reported in Brazil and Indonesia (Ramos *et al*., 2015; Manggala *et al.*, 2018). This is in line with the results by Manggala *et al.* (2018) and Dhingra *et al.* (2021), who examined Indian data on child stunting on the impact of short birth spacing on birth order disparities and found that children in lower birth orders were taller than those in higher birth orders (Manggala *et al*., 2018; Dhingra *et al.*, 2021). These findings corroborate the results of a study which was a health and demographic survey done in Zambia in 2014 among children aged 0 to 5 years (Mzumara *et al.*, 2018). There different reasons for child stunting were found, including shortage of clean water, the inability of households to make money, length of nursing, or filthy living conditions brought about by subpar child care (Verma and Prasad, 2021).

Prevalence of underweight

Results from the study revealed that where there is either no consumption of ASFs, from different livestock kept by the household or where there is low consumption and a higher risk of being underweight is inevitable. The study found that there was no or low consumption of goats which thus was highly associated with the prevalence of underweight of 17.0% among children aged 6 to 59 months in the study area. Different studies concur with these findings.

This study found that low or non-consumption of goat meat had a higher risk of causing underweight. A study done in Eastern Cape South Africa reported that people do not consume goat meat due to its taste, cultural bias, strong smell, and natural dislike of the people (Idamokoro *et al.*, 2019). Furthermore, people in the study area were not consuming goat meat mainly due to high prices and poverty.

Another factor that showed a higher odd ratio in causing underweight was child growth monitoring. Child growth monitoring during reproductive child health clinics (RCH) is an important underlying factor of under nutrition. Some studies suggest that child sex, low birth weight, and irregular attendance of children in RCH are key factors that contribute to children being underweight. The present study shows that low birth weight and poor RCH attendance were associated with a generally higher risk of children being underweight. These findings are similar to findings previously found by Woldie *et al.* (2015) and Verma and Prasad (2021) who conducted a study on underweight in developing countries as one of the systematic reviews (Verma and Prasad, 2021).

Strength of the study

The study was based on a community exploratory survey with 413 households and involved children aged 6 to 59 months. The study accurately portrays the genuine livestock keeping and consumption picture in relation to the nutritional situation. The large sample size of 413 households had a lot of producing power in producing results.

Weaknesses

Despite the fact that bias recollection was reduced, questioning and reporting might have caused the caretaker to forget some of the questions, particularly those pertaining to long-ago episodes. Another weakness of the study was the budget deficit which was caused by a lack of financial sponsorship, which made it difficult to incorporate everything that was required.

Limitations

In terms of type, number, and frequency of consumption,

the households visited were rather uniform in their livestock husbandry, and the obstacles might have made identifying distinctions more difficult. It is important to remember that the level of livestock keeping varies by rural area. The aim of maintaining livestock, as well as income, prices, and access to animal sources, as well as animal intake and availability, may vary from one location to another one. This study was conducted from January to May 2020/2021 during the rainy season, when the respondents were heavily involved in agricultural techniques; this might have contributed to the low consumption of animal-source foods. Furthermore, due to the heavy demands of agriculture, some people were spending many hours without eating, as many farms are located far from their particular homes. Part of the data was gathered prior to Christians fasting for forty days, which is when their households' purchasing power is likely to be lower. Data gathering on a yearly basis could have helped to provide a more accurate picture of the livestock kept and consumption in this area. Consumption recall, analytical errors, and respondents' under- and over-reporting might have contributed to data bias. On average, these factors should balance out, although they may be more important at the individual level than at the family level. Variations among individuals in the families would be improved by the observation that lasted more than one day. In rural areas, when animal food sources are sold in the roasted form, there is a particular issue that favours men rather than women.

CONCLUSION AND RECOMMENDATION

The study revealed that there were low keeping and consumption of livestock that showed higher significant odd ratios (risk). Additionally, there was a positive association between low or no diversified domesticated animal source foods consumed in causing undernutrition (stunting and underweight) but not wasting. The study shows that low-consumption goats showed higher odd ratios in causing undernutrition because of low consumption. The authors recommend that households in the study area should be encouraged to keep more livestock and consume Animal Source Foods (ASFs) in order to help reduce undernutrition in children aged 6 to 59 months.

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