



Factors That Contribute To Stunting Of Children Less Than Two Years In Food Secure Regions: A Comparative Study Of Urban And Rural Uasin Gishu

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Abstract

Stunting is low height for age with poor brain and physical development. It affects about one fifth of children less than five years globally with Africa having 39% in 2017. Stunting develops during pregnancy and in children 0-23 months due to inadequate nutrition. It results to increased morbidity, mortality, reduced individual output, and predisposes children to chronic illnesses. Some surveys have shown stunted children are found in food secure areas. However, there seems to be a major research gap on factors contributing to stunting in such areas more so in Uasin Gishu County. The purpose of this study was to determine the contributors to high prevalence of stunting in children less than two years in Uasin Gishu County. A comparative cross-sectional survey design was used for this study. A sample size of 331 stunted children aged 0-23 months were recruited using multistage, systematic random sampling. The results show more stunted females than males at χ^2 ($P=0.001$) with most of the children cared for by their biological mothers 92% (305/331). More urban children who were less than six months were exclusively breastfed compared to rural children, χ^2 ($P=0.001$). More rural than urban children 6-23 months were still breastfeeding at χ^2 ($P=0.001$). Children who lived in the rural area had a higher dietary diversity score ≥ 4 compared to urban children. Eggs were least fed food for both urban and rural children respectively (13/269:11/88). Rural children had a higher intake of vitamin A rich foods compared to urban children. Sub optimal feeding for the urban children six to twenty three months and rural children less than six months may be a contributing factor for stunting in children who are less than two years of age.

Key words: Stunting, children, foods, food secure, nutrition

1) Introduction

Poor nutrition status that includes stunted growth in children is a global challenge which has been addressed over years through Millennium development goal four that started in 2000 ended in 2015 of reducing child deaths. It's now been given a new focus through Sustainable Development Goal 2 that need to be achieved by 2030 of ending hunger, achieve food security, good nutrition and promote agriculture, (Prendergast, & Humphrey, 2017). Worldwide stunting is estimated at 22.2% in 2017 a reduction from 32.6% in 2000. Asian continent had the highest rate estimated at 55% with Africa coming in second at 39%, (UNICEF, WHO, IBRD and Development/The World Bank, 2018).

WHO defines stunting as height for age of less than -2 Z score. This are derived from the measure of height for age for boys and girls, ("WHO Child Growth Standards," 2006). It's also been defined as a failure to attain growth both physically and cognitively with effects that last for a life time. In a systematic analysis, it was concluded that the most likely period for stunting to occur as the first 1000 days of a child's life starting from conception to 2 years of age. Stunting occurs intrauterine due to poor nutrient supply to the



fetus or after birth when optimal nutrition is not attained, (Prendergast et al., 2017). Other studies have documented the first 1000 days of life as the window period in which corrective interventions are responsive making this period of growth important in addressing stunting in children, (C. G. Victora, P. C. Hallal, M. Blossner., 2010).

K. G. Dewey & Adu-afarwuah, (2008), in a review of studies on complimentary feeding found that ages 6 to 24 months had the highest occurrence of growth faltering and micronutrient deficiencies. They also concluded that it was difficult after 2 years to reverse the growth retardation that occurred in height, brain and other functional and metabolic impairments predisposing the individuals to diabetes, hypertension and cardiac diseases in adulthood, (Hassen, Gizaw, Belachew, 2017 & Prendergast et al., 2017). Other documented risks include high morbidity and mortality due to poor immunity in stunted children. This has been attributed to low fat mass, that is a characteristic of stunted children and affects the immune response, making stunted children vulnerable to disease, (Briend, Khara, & Dolan, 2015, Yaméogo et al., 2017).

In 2015 countries were given a challenge to work towards ending all forms of malnutrition and reduction in stunting by 40% by 2025, (Research Institute IFPRI, 2016). Kenya had 26% stunting prevalence in 2014 a drop from 35 % in 2008/09. West Pokot and Kitui counties recorded the highest stunting rates at 45.9% and 45.8% respectively. Stunting was also observed in some areas designated to be food secure counties in Kenya according to a report by (Security, 2016), as Uasin Gishu (31.2%), Nandi (29.9%) and Trans Nzoia (29.2%). But some agricultural rich counties with an example of Nyeri County which is a food secure, had the lowest stunting rates of 15.1%. Turkana which is relatively drier classified as food insecure, had a stunting rate of 23.9% which was lower than some food producing regions, (Survey & Indicators, 2014). There seems to be a major research gap in some food secure regions in Kenya on factors contributing to stunting and more so in Uasin Gishu County. This therefore requires studies to establish factors that result in stunting to ensure informed interventions by both county and national governments.

2) Methodology

A comparative cross sectional survey was used in this study. The study was conducted in Huruma and Ng'enyilel ward of Turbo Sub County, Uasin Gishu County targeting children less than two years. A sample size of 331 children less than two years was derived using Fishers formula ($n = z^2 pq / d^2$), Fisher et al (1991). Using a multistage systematic random sampling, community units were selected from the two wards (Huruma and Ng'enyilel) from which villages were random sampled. Every n^{th} child was selected from the villages and studied. Reliability was ensured by training the data collectors and clarifying questions. Exclusion from the study was done for caregiver, child or both who were not at home at the time of the study, and for mentally disabled caretakers who could not give coherent information about their children. A questionnaire was used in this study and pre testing of the study instruments was done in Kapsaos ward, which is one of the six wards in Turbo Sub County. Data was collected by asking questions and filling in the questionnaires. Every child's length was taken using a length board and tallied in the Weight for Age growth chart from which stunting was determined as below minus two standard deviations from the medium height for age of the reference population. Permission to collect data was sought from Kabarak University Ethics Research Committee and National Commission for Science and Technology.

3) Results

3.1 Demographic information



This section presents data on respondent’s information. Children who participated in the study were distributed from ages 0-23 monthswith 30.5% being between 18-23 months and 18.7% at 0-6 months. There was significant difference in the distribution of stunting across different age groups with χ^2 (p=0.041) between urban and rural children and distribution between males and females at χ^2 (p=0.001) with more females stunted than males. Most of the children were taken care of by their biological mothers (92.1%). See Table 1

Table 1: Respondents Demographic Information

		Residence			Chi square results	Fisher exact test	
		Urban	Rural	Total	P value	P value	
		n=215	n=116	n=331	=0.05	=0.05	
		n (%)	n (%)	n (%)			
Child’s age group	0-<6	34(15.8)	28 (24.1)	62(18.7)	0.041*	***	
	6-11	60 (27.9)	22 (19.0)	82(24.8)			
	12-17	55 (25.6)	31 (26.7)	86(26.0)			
	18-23	66 (30.7)	35 (30.2)	101(30.5)			
Childs gender	Males	96(44.7)	52(44.8)	148(44.7)	0.001*	***	
	Female	119(55.3)	64(35.0)	183(55.3)			
Caregivers relationship to child	Mother (female parent)	199(92.6)	106(91.4)	305(92.1)	**	***	
	Father (male parent)	4(1.9)	5(5.3)	9(2.7)			
	Grandmother	5(2.3)	3(2.6)	8(2.4)			
	Other	7(3.3)	2(1.7)	9(2.7)			
Caregivers education	No formal education	1 (0.5)	6(5.2)	7(2.1)	**	***	
	Primary	84 (39.1)	71(61.2)	155(46.8)			
	Secondary	104 (48.4)	33(28.4)	137(41.4)			
	College	26 (12.1)	6(5.2)	32(9.7)			
Number of household members	2	2(0.9)	2(1.7)	4(1.2)	**	***	
	3	68(31.6)	15(12.9)	83(25.1)			
	4	64(29.8)	25(21.6)	89(26.9)			
	5	50(23.3)	26(22.4)	76(23.0)			
	6	25(11.6)	21(18.1)	46(13.9)			
	7	6(2.8)	16(13.8)	22(6.6)			
	8	0(0.0)	9(7.8)	9(2.7)			
Mean HH		4	5	4.5	**		
	Religion	Christian	213(99.1)	116(100.0)			329(99.4)
		Muslim	2(0.9)	0(0.0)	2(0.6)		

*Significant value

** Not applicable for chi square analysis (cells with less than 5 counts)

*** Only for 2*2 tables

3.2 Foods consumed by Children

Analysis on foods consumed was done for children less than 6 months and children 6 -23 months. Mixed feeding was the most practiced mode of feeding (43.5%) for children <6 months, for both urban and rural respondents followed by exclusive breastfeeding (40.3%). Exclusive breastfeeding rates were higher at 42.9% in the rural and 38.2% in the urban area. More children in urban areas received liquids and water in addition to breast milk as predominant breastfeeding was at 17% compared to rural areas at 7.1%. See Table 2



Table 2: Breastfeeding type for children less than 6 months by residence

Residence	Age 0-<6 months (n)	Breastfeeding type			Total N
		Exclusive Breastfeeding n(%)	Predominant Breastfeeding n(%)	Mixed Feeding n(%)	
Urban	(34)	13(38.2)	6(17.6)	14(41.2)	34
Rural	(28)	12(42.9)	2(7.1)	13(46.4)	28
Total	(62)	25(40.3)	8(12.9)	27(43.5)	62

Key: Exclusive breastfeeding (Breast milk alone and no other food, liquid or water except prescribed medication)

Predominant breastfeeding (Breast milk plus clear liquids, fruit juice, ritual liquids and water)

Mixed feeding (Breast milk plus other foods including non human milk)

Results on breastfeeding of children 6-23 months were presented as breastfed or not breastfed. Children 6-23 months who received breast milk the previous day were 69.5% and those not breastfed were 30.5%. There was a high significant difference χ^2 ($p < 0.001$) between children who were being breastfed in urban and rural with more children in the urban having been breastfed the previous day than rural areas. See Table 3

Table 3: Breastfeeding for children 6 – 23 months

Residence	Childs age 6-23 months (n)	Breastfeeding		Chi square results P value =0.05
		Breastfeeding n (%)	Not breastfeeding n (%)	
Urban	(215)	131(72.4)	50(27.6)	0.001*
Rural	(116)	56(63.5)	32 (36.4)	
Total	(331)	187(69.5)	82 (30.5)	

*Significant value

WHO guidelines on assessing infant and young child feeding, recommends seven food groups from which a child should be measured against. A child is expected to eat a minimum of four food groups to achieve minimum acceptable nutrient diversity. The individual foods are grouped into 7 groups namely carbohydrate sources (grains, roots and tubers), legumes and nuts, milks and milk products (cheese, yoghurt, traditionally fermented milks), flesh foods, eggs, vitamin A rich foods (yellow fleshed foods), and fruits and vegetables. The results show the proportion of children who ate from each food group. Carbohydrates foods were eaten most in urban at 97.2%/n=196 and rural 94.3%/n=83. Eggs were eaten least with 7.2% urban and 12.5% rural. There was no differences in consumption of all food groups between urban and rural children except intake of vitamin A rich foods with a significant difference χ^2 ($p=0.001$). Vitamin A rich foods were eaten more in the rural areas compared to urban areas at 14.4%. See Table 4

Table 4: Individual food groups consumed by children 6-23 months

Individual food groups	Response	Urban N =181	Rural N=88	Chi square P=0.05
		n(%)	n(%)	
Cereals, roots, tubers	Yes	176(97.2)	83(94.3)	0.338
	No	5(2.8)	5(5.7)	
Legumes, nuts	Yes	31(17.1)	19(21.6)	0.282
	No	150(82.9)	69(78.4)	
Milks and milk products	Yes	102(56.4)	54(61.4)	0.725



Flesh foods	No	79(43.6)	34(38.6)	0.481
	Yes	40(22.1)	15(17.0)	
Eggs	No	141(77.9)	73(83.0)	0.250
	Yes	13(7.2)	11(12.5)	
Vitamin A rich foods	No	168(92.8)	77(87.5)	0.001*
	Yes	26(14.4)	31(35.2)	
Fruits and vegetables	No	155(85.6)	57(64.8)	0.862
	Yes	126(69.6)	64(72.7)	
	No	55(30.4)	24(27.3)	

*Significant difference

Dietary diversity scores for children 6-23 months showing the total number of food groups consumed by a child in the last 24 hours. The dietary diversity score (DDS) of 3 was highest for both urban (42.0%/n=76) and rural at 35.2%/n=31. Number of children who had DDS of 5 was 5.2% and DDS of 6 were the least at 1.5%. No child received 7 food groups. See Table 5

Table 5: Dietary diversity score for children 6-23 months

Residence	Dietary diversity score for children 6-23 months							n
	DDS=1 n(%)	DDS=2 n(%)	DDS=3 n(%)	DDS=4 n(%)	DDS=5 n(%)	DDS=6 n(%)	DDS=7 n(%)	
Urban	10(5.5)	53(29.3)	76(42.0)	33(18.2)	7(3.9)	2(1.1)	0(0.0)	181
Rural	10(11.4)	13(14.8)	31(35.2)	25(28.4)	7(8.0)	2(2.3)	0(0.0)	88
Total	20(7.4)	66(24.5)	107(39.8)	58(21.6)	14(5.2)	4(1.5)	0(0.0)	269

Results on minimum acceptable dietary diversity score shows the number and proportion of children who consumed at least four food groups the previous day within different age groups. The total number of children who had a dietary diversity score of four and above were 28.3%/n=76, with urban and rural having 23.2%/n=42 and 38.6%/n=34 correspondingly. See Table 6

Table 6: Low and Minimum dietary diversity score for children 6-23 months

Residence	Childs age in months	Dietary diversity score				n
		1 n(%)	2 n(%)	3 n(%)	≥4 n(%)	
Urban	6-11	5(8.8)	12(21.1)	29(50.9)	11(19.3)	57
	12-17	4(6.6)	24(39.3)	20(32.8)	13(21.3)	61
	18-23	1(1.6)	17(27.0)	27(42.9)	18(28.6)	63
	6-23	10(5.5)	53(29.3)	76(42.0)	42(23.2)	181
Rural	6-11	1(4.8)	5(23.8)	7(33.3)	8(38.1)	21
	12-17	5(15.2)	2(6.1)	16(48.5)	10(30.3)	33
	18-23	4(11.8)	6(17.6)	8(23.5)	16(47.1)	34
	6-23	10(11.4)	13(14.8)	31(35.2)	34(38.6)	88
Total	6-11	6(7.7)	17(21.8)	36(46.2)	19(24.4)	78
	12-17	9(9.6)	26(27.7)	36(38.3)	23(24.5)	94
	18-23	5(5.2)	23(23.7)	35(36.1)	34(35.1)	97
	6-23	20(7.4)	66(24.5)	107(39.8)	76(28.3)	269

The place of residence and dietary diversity score showed a significant relationship with a Chi square value of (χ^2 13.467, p=0.004). This means the place of residence influenced the number of food groups eaten with rural children being fed better than urban children.



Children who received minimum acceptable diet of ≥ 4 food groups the previous day and night were at 38.6% /n=34, rural and 23.2%/n=42, urban. More of the urban children were fed between 2 and 3 food groups at 29.3%/n=53 and 42.0%/n=76 respectively. See Table 7

Table 7: Dietary Diversity Scores for Rural and Urban areas

Dietary Diversity Score (DDS)	Residence		Chi square value	P value
	Urban n=181 n(%)	Rural n=88 n(%)		
DDS = 1	10(5.5)	10(11.4)	13.467	0.004*
DDS = 2	53(29.3)	13(14.8)		
DDS = 3	76(42.0)	31(35.2)		
DDS ≥ 4	42(23.2)	34(38.6)		

*Significant value

The relationship between severity of stunting and dietary diversity score was determined and no relationship was observed for both urban and rural children. See Table 8

Table 8: Severity of stunting and dietary diversity score

DDS	Urban		Chi square results P=0.05	Rural		Chi square P=0.05
	Stunted n=139 n (%)	Severe stunting n=76 n (%)		Stunted n=79 n (%)	Severe stunting n=37 n (%)	
DDS=1	5(4.3)	5(7.6)	0.707	5(8.3)	5(17.9)	0.266
DDS=2	35(30.4)	18(27.3)		8(13.3)	5(17.9)	
DDS=3	50(43.7)	26(39.4)		20(33.3)	11(39.3)	
DDS=4	25(21.7)	17(25.8)		27(45.0)	7(25.0)	

4) Discussion

The study indicated children less than two years had stunting with significant difference in their gender distribution with more females than males in both urban and rural areas. This distribution was also seen in one study carried out in Baringo Kenya that found more females than males to be stunted, (Walingo M., Sewe T., 2015). Although an analysis of demographic survey data indicated, Kenya among other countries had stunting prevalence more in males than females, (Jonah C., Sambu W., 2018). Most of the stunted children were between 18-23 months and least seen in children zero to six months with a large difference in their distribution between urban and rural which concurs with the survey results, (Survey & Indicators, 2014). Stunting in these children can be attributed to the cumulative effect of lack of nutrients and lack of correct interventions when children present with wasting earlier. These results also agree with Ekpo et al., (2008) study that found that rates of stunting were found to be highest in children twelve to twenty three months. A similar observation was made by Herrador et al., (2014) who reported that the probability of being stunted in children increased with age with more wasting seen at 6-11 months and stunting observed as children progressed in age.

Stunting observed in children less than 6 months in this study could be attributed to poor nutrition since exclusive breastfeeding rates were low in this age group. This observation was also made in a longitudinal study that observed growth faltering in length in some children in developing countries occurred in the first few months after birth as a result of poor feeding (Prendergast et al., 2017). This could also be due to poor breastfeeding techniques that include wrong positioning and attachment of the baby to the mother's breast. When breastfeeding is done correctly a child gets enough breastmilk which



has been found to supply all required nutrients with changing composition from colostrums, transitional and mature milk that occurs within the first weeks after birth meeting the different physiological needs as the child grows, (Sendukilde et al., 2016). Other studies also show exclusive breastfeeding benefits a child by increasing colonization of a child's gut with beneficial micro-organisms which is less seen in mixed fed children This ensures maintenance guts structural integrity, controlling of a child's immune reaction and protections against harmful microbes, (Martin et al., 2016, Walker & Walker, 2013). Since mixed feeding was most practiced for children below six months in this study, it implies that they are not receiving required nutrition for growth in length and miss the other benefits of exclusive breastfeeding.

Although exclusive breastfeeding contributes to increase in length in children 0-6 months, it has also seen to be positively associated length for age z scores of children 6-11 months than predominant breastfeeding and mixed feeding, (Kamudoni, Maleta, & Shi, 2014). In addition to this a child's gastro intestinal system is been found not ready to digest other foods other than breast milk or breast milk substitutes when necessary at this age. Thus, early introduction of food to children less than 6 months as observed in this study and use of liquids in addition to breastmilk for the predominantly breastfed children interferes with intake of sufficient breastmilk, optimal nutrient digestion and absorption affecting child growth as indicated by (Martin et al., 2016). Therefore, interventions focused towards promotion of exclusive breastfeeding are required for children 0-6 months to reduce stunting.

The study had about a third of children six to twenty-three months who had ceased breast feeding. In a systematic review of studies on complimentary feeding, breast milk was found to provide about half of energy requirements for children 6-11 months and a third of the energy requirements for 12-23 months, therefore lack of this supply as observed in this study denies a child required nutrients for growth, (Dewey & Brown, 2003). Other studies further observed that sub optimal breastfeeding and early cessation of breastfeeding increased morbidity in children especially diarrhoea and pneumonia that hamper nutrient intake and absorption, leading to stunting in the long run (Sankar et al., 2015). Kasai & Republic, (2009) agrees with that early stoppage of breastfeeding as seen in this study was found to be one of the causes of stunting in food secure areas. Since the place of this study is classified as food secure, with most households consuming at least six food groups, Security, (2016), poor breastfeeding practices could be a contributor to stunting.

In addition to early cessation of breastfeeding, about two thirds of the children 6-23 months did not receive minimum acceptable diet with more rural children having higher dietary diversity scores than urban children. This may be attributed to rural families easily accessing some foods from their farms and neighborhoods at a cheaper price as compared to urban areas that mainly rely on purchasing foods. Studies have shown that lack of enough nutrient supply between ages 6-11 months leads to repeated wasting occurrences, that later result to stunting, (Briend et al., 2015). This is further explained by Motbainor et al., (2015) who found out that children above six months who were exclusively breastfed became stunted if they consumed a less diverse diet. A dietary diversity score that was used in this study that recall food groups taken with 24 hours has been found to be a good measure of nutrient adequacy and affect a child height and weight, (Steyn, Nel, Nantel, Kennedy, & Labadarios, 2017). Yet the study found most of children had dietary diversity score of less than four food groups. This therefore, shows inadequate nutrient supply in the study group resulting to stunting and has been linked more to food diversity than food security as the later was seen to contribute more to wasting in children, (Motbainor et al., 2015).

Intake of certain foods has been linked to higher increase in children's height which includes eggs, fish, chicken liver and milk. This is because these foods supply essential



amino acids, provide iron, calcium and zinc, (Dewey & Adu-afarwuah, 2008). Zinc has also been found to be an important growth component for height where children with low height had low plasma zinc concentrations and in addition micronutrients as calcium, magnesium, and iron, (Hess, 2017). Results from this study indicated low intake of animal source foods with eggs being the least consumed food. But there was a significant difference on milk consumption between urban and rural children with rural children consuming more milk than urban. This could be due to the fact that most rural households produce milk as part of their economic activities and milk is more available at low cost in the rural area than urban. Therefore, most children in this study did not receive enough food that supplies essential nutrients needed for linear growth and this could be one of the explanations for stunting.

Vitamin A is an important nutrient in boosting immunity, improving sight and cell regeneration. From the study, about two thirds of the children from both urban and rural areas did not receive vitamin A rich food such as yellow fleshed sweet potatoes, carrots, mangoes and pumpkins among others. Therefore they miss the potential benefit of vitamin A in the body of reducing morbidity and mortality, (Stevens et al., 2015). Although vitamin A has many benefits in children, its effect on length of children gave both positive and no correlation, but had a shown a proven effect in reducing disease, (Kimani-murage, Ndedda, Raleigh, & Masibo, 2012). Since frequent illness leads to wasting and recurrent wasting has been observed to result to stunting then lack of Vitamin A may indirectly be contributing to increased rates of stunting in this study group. Sub optimal feeding was observed in this study and education to caregivers on feeding children would improve child growth.

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