Early Childhood Nutrition Knowledge of Caregivers in Tanzania

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Abstract: Childhood stunting is a pressing health issue in Tanzania and results from chronic infections and inadequate nutrition. Educating caregivers on the nutritional determinants, their consequences, and appropriate solutions may improve nutrition-related practices among caregivers in Tanzania. The purpose of this study was to identify factors associated with Tanzanian caregivers' knowledge of childhood nutrition practices. Data for this study came from a cross-sectional survey of 4,095 caregivers of children under 24 months living in the Geita, Kagera, Kigoma, Mwanza, and Shinyanga regions of Tanzania. Complete responses relating to demographic and socioeconomic factors, media exposure, and early childhood nutrition knowledge were analyzed using multiple linear regression modeling techniques. Caregivers' knowledge concerning proper early childhood nutrition practices was found to be significantly related to using a mobile banking account ($p<.0001$), owning a working radio with batteries ($p<.0001$), having watched television recently ($p<.0001$), residing in a southern lake region ($p<.0001$), affiliating with a Christian faith ($p=0.0027$), having more children under the age of 5 ($p=0.0005$), having received advice on maternal nutrition before pregnancy ($p<.0001$) and having received advice from a community health worker ($p=0.0184$). Living in a rural environment *($p<.0001$)* and speaking a non-mainstream language *($p<0.05$)* were significantly associated with decreased knowledge. The influences of media and technology, socio-demographic factors and traditional health education may be important in the development of accurate childhood nutrition knowledge among caregivers. These factors may be targeted for future community health worker efforts with vulnerable populations in Tanzania to prevent stunting.

INTRODUCTION

The World Health Organization defines stunting as the impaired growth and development in children resulting in a height-for-age z-score more than two standard deviations below the WHO Child Growth Standards median [1]. Stunting may stem from poor nutrition, repeated infection, and inadequate psychosocial stimulation. During 2017, an estimated 150 million children worldwide under age 5 were stunted [2], making stunting the most common form of malnutrition among children in this age group [3]. Stunted children may experience developmental challenges that persist later in life. In particular, stunting is linked to impaired cognitive development, lower school achievement, and lower economic productivity as an adult [4]. Stunted children are also more likely to suffer from or die from infections including pneumonia, sepsis, tuberculosis, meningitis and diarrhea [3]. The relationship between nutrient deficiency and infection is a vicious cycle; children who are malnourished are more likely to get sick, and when children get sick, the few nutrients they have are directed to the immune response rather than towards growth [3].

As many as 30-50% of stunting cases worldwide are found in Central and East Africa [3, 5]. The prevalence of stunting among children in Tanzania under the age of 5 years is 34% [6]. In Tanzania, many young children receive only a small proportion of their daily nutritional requirements. For example, young children between 6-8, 9-11, and 12-23 months of age only consume 15%, 20%, and 27% of their daily iron requirements, respectively [7]. Indeed, dietary deficiencies are the leading causes of stunting in children [8]. Other risk factors include pregnancy complications, infections in mother and/or child during pregnancy, and a lack of nurturing or early stimulation [9]. Despite these findings, there is a gap in the current literature regarding the extent to which caregivers in Tanzania obtain information about stunting prevention, including early childhood nutrition practices [10].

The purpose of this study was to identify factors associated with Tanzanian caregivers' knowledge of childhood nutrition practices, and to explore the relationship between exposure to media and communication technology, sociodemographic factors, and traditional health education approaches and caregivers' knowledge.

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METHODS

Design and Sample

Data for this study came from a cross-sectional survey of female caregivers of children under 24 months of age living in the Geita, Kagera, Kigoma, Mwanza, and Shinyanga regions of Tanzania. Data were collected in January and February of 2016. Of the initial 5,000 caregivers interviewed, 4,095 had complete data and were included in analyses. The study used district-level probability proportional to size sampling based on the most recent Tanzania census conducted in 2012 as the sampling frame.

Procedure

Authorization to conduct the research and recruit study participants was obtained from local authorities, including Regional Medical Officers (RMOs) and/or District Medical Officers (DMOs). Ethical clearance was obtained from the National Institute for Medical Research in Tanzania (NIMR/HQ/R.8a/Vol.IX/2344). The researchers then visited wards and traveled to randomly selected villages/streets. Within each village, the survey team began the sampling process with the assistance of the Village Executive Officer or another village guide who introduced the survey team to households. After enumerator training, the survey team pilot tested and finalized the interview guide. Interviews were conducted in Kiswahili. The team made a maximum of three attempts to visit households before they substituted them with replacement households.

MEASUREMENT

Demographic information such as age, gender, education, ethnicity, languages spoken, languages understood, literacy, and region were collected from respondents. These were included as control variables in the assessment of media exposure on early childhood nutrition knowledge. An asset index was constructed to adjust for socioeconomic status. The asset index was calculated by summing "assets" that caregivers were asked about in the interview and that reflected household ownership of a bicycle, motorcycle, car or truck, animal drawn cart, boat with motor, boat without motor, radio, television, mobile phone, refrigerator, table, chairs, bed, air conditioner, computer, electric iron, fan, power tiller, connection to the national electricity grid, active mobile banking account and owning more than one acre of agricultural land. Ownership of each asset resulted in a value of 1,

and the asset index was a simple summation of all the asset's values.

Media exposure was assessed by determining whether the respondent's household possessed a television, a radio, a working radio with batteries, a mobile phone, *WhatsApp*, or a computer and the frequency with which they watched television or listened to the radio. Whereas smartphone ownership was not measured, *WhatsApp* is an app that only runs on a smartphone. A "yes" response was coded as having been exposed to media. Otherwise respondents were considered to have no media exposure. Television viewing was measured by asking respondents if they had viewed television in the past day, past 7 days, past month, past few months, or more than the past few months.

A health knowledge scale score was created by assessing whether the respondent accurately answered questions concerning early childhood nutrition. The following questions were included: "How long after birth should a baby start breastfeeding?", "What should a mother do with the 'first milk' or colostrum?", "At what age should you start feeding a baby other types of food such as water, clear liquids, or milk from other sources?", "If a mother thinks she does not have enough breast milk, what should she do?", and "At what age can you start giving a young child the following foods?" The final question included four sub-categories: semi-solid foods, solid foods, eggs, and animal meats. For the first four questions, a correct answer resulted in a score of 1. For the last question, a score of .25 was awarded for each correct answer on the sub-categories. Incorrect answers resulted in a 0. A total health knowledge variable was then created by adding the values from the five questions and resulted in a possible range of 0-5. Higher scores on this health knowledge scale of 0 to 5 were indicative of greater correct health knowledge, while lower scores indicated less knowledge.

Analysis

Stepwise automatic model selection in SAS 9.4 was used to identify variables with a significant association with the knowledge composite score. Variables were included or removed from the multiple regression model based on whether the variables kept the probability that the model's relationship to the health knowledge composite score occurred by chance under 5% ($p<0.05$). For variables that were identified as significant in the model, but without significant

relationships for one or more of their categories, Bonferroni adjusted and unadjusted pairwise comparisons were used to identify categories to combine to improve the model.

Bonferroni pairwise comparison showed a significant difference between northern regions (Kagera and Mwanza) and southern regions (Shinyanga, Geita, and Kigoma) so region was re-coded to reflect this distinction. No pairwise differences were found among any of the religious identifications that did not identify as Christian, including Islam, so religion was re-coded based on pairwise differences to reflect whether caregivers identified as some category of Christianity (yes/no). Television viewing frequency categories were also re-coded based on pairwise differences to reflect whether caregivers had watched television recently (yes/no). Recent watching included respondents that reported the past day through the past few months. Not recent included those that reported more than the past few months. No discernable trend or pairwise difference was identified for the categories of language spoken or ethnicity, so they were removed from further model selection. After adding the new variables for

Table 1: Sample Demographics

Region	N	%	What language do you speak on a daily basis?	N	%
Kagera	995	24.30	English	6	0.15
Mwanza	1045	25.52	Swahili	1478	36.09
Shinyaga	613	14.97	Haya	395	9.65
Geita	707	17.26	Kewere	51	1.25
Kigoma	735	17.95	Sukuma	1146	27.99
Setting	**N**	**%**	Kiha	567	13.85
Urban	699	13.89	Kihangaza	67	1.64
Rural	4301	86.02	Kisubwa	51	1.25
What is your highest level of education?	**N**	**%**	Kizinza	39	0.95
No formal education	769	18.78	Other language	295	7.20
Some primary	438	10.70	**Which other languages do you understand? ***	**N**	**%**
Complete primary	2386	58.27	English	135	3.30
Some secondary	155	3.79	Swahili	4095	100.00
Complete secondary	312	7.62	Haya	575	14.04
Some high school	2	0.05	Kewere	102	2.49
Complete A level	10	0.24	Sukuma	1950	47.62
Some college	8	0.20	Kiha	797	19.46
Complete college	5	0.12	Kihangaza	108	2.64
Some university	3	0.07	Kisubwa	98	2.39
Complete university	7	0.17	Kizinza	88	2.15
Religion	**N**	**%**	Other	622	15.19
Protestant	368	8.99		**Mean**	**SD**
Catholic	2177	43.54	**How many children under age 5 do you have?**	1.64	0.69
Pentecostal	728	14.56	**How many children have you had in total?**	3.47	2.29
Other Christian	817	16.34	**Age of Caregiver in Years**	27.4	7.09
Muslim	541	10.82	**Asset Index**	4.71	2.06
Traditionalists	7	0.14	**Can you read?**	**N**	**%**
Other religion	95	1.90	Yes	3057	74.65
No religion	191	3.82	No	1038	25.35

Note: Categories may overlap and are not all inclusive.

region, religion, and whether respondents had ever watched television, the automatic variable selection program was run a second time on the study variables to produce the final model.

RESULTS

Table **1** shows the sociodemographic characteristics of respondents. The average age of respondents was 27.4 years. Most lived in the Mwanza (25.52%) and Kagera (24.3%) regions of Tanzania, and nearly all reported residing in rural settings (86.02%). Over half of the sample reported having completed a primary education (58.27%) and were literate (74.65%). Most affiliated with a Christian faith (84.70%). Table **2** presents information about exposure to media and technology. The most common technologies utilized by respondents were radio (46.52%) and mobile phones (39.98%), followed by use of active mobile banking (27.2%). Despite low proportion of TV ownership (8.3%), three-quarters of the sample (76.31%) reported having watched television recently.

Table 2:   Exposure to Media and Technology

Which of the following do you have?	*N*	*%*
Mobile phone	1637	39.98
Active mobile banking account (e.g., M-pesa)	1114	27.2
Radio	1905	46.52
TV	340	8.3
Computer	12	0.29
If respondent owns a radio, does the radio in your household have batteries and is it working?		
Yes	1523	37.19
TV Frequency		
Recent	3125	76.31
Not recent	970	23.69
Do you have *WhatsApp* on your mobile phone?		
Yes	140	3.42

*Did not require that caregiver owned a TV.

Results relating to respondent knowledge about early childhood nutrition are shown in Table **3**. The average knowledge score was 2.86 (SD = 0.99, Range 0-5). Specifically, 61.23% of caregivers correctly reported that babies should start breastfeeding immediately after birth, and 22.22% reported that it is best to wait 1 hour. Most (81.86%) were correct in noting that colostrum should be given to a baby by breastfeeding soon after birth. In instances where the mother does not have enough breast milk, caregivers

Table 3:   Early Childhood Nutrition Knowledge

	Mean	*SD*
Knowledge Composite Score	2.87	0.98
At what age in months should you start feeding a baby other types of food such as water, clear liquids, or milk from other sources?	5.97	1.52
At what age can you start giving a young child the following foods?	*Mean*	*SD*
Semi-solid foods (porridge)	6.19	1.98
Solid foods	8.49	3.10
Eggs	5.84	3.10
Animal Meats	10.51	5.51
How long after birth should a baby start breastfeeding?	*N*	*%*
Immediately	2511	61.32
Less than 1 hour after delivery	910	22.22
Some hours later but less than 24 hours after delivery	373	9.11
1 day after delivery	60	1.47
More than one day after delivery	9	0.22
Does not think baby should be breastfed	2	0.05
Don't Know	230	5.62
What should a mother do with the first milk or colostrum?		
Throw it away and start breastfeeding once the rest of the mother's milk comes in	480	11.72
Give it to her baby by breastfeeding soon after birth	3352	81.86
Other	20	0.49
Don't know	243	5.93
If a mother thinks she does not have enough breast milk, what should she do?		
Breastfeed more often	484	11.82
Keep breastfeeding the same amount	341	8.33
Breastfeed less often	112	2.74
Stop Breastfeeding	61	1.49
Give the baby other liquids	2659	64.93
Give the baby other foods	1139	27.81
Did you receive advice on maternal nutrition before your pregnancy?		
Yes	698	17.05
No	3397	77.34

mostly reported that they would give the baby other liquids (64.93%), rather than breastfeed more often (11.82%) or breastfeed the same amount (8.33%). The ages at which caregivers reported it appropriate to give children liquids (5.97 months), semi-solid foods (6.19 months), and eggs (5.84 months) were very close to 6 months. They reported they would give solid foods (8.49 months) and animal meats (10.51 months) later.

Table **4** shows the results of multivariate regression

Table 4: Factors Associated with Early Childhood Nutrition Knowledge

Variable	Estimate	P-Value
Intercept	2.42904	<0.0001
Understands Kizinza	-0.21485	0.0382
Understands Kihangaza	-0.204543	0.0316
Rural	-0.16	0.0004
Understands Other Language	-0.113578	0.0096
Number of children aged under 5	0.078	0.0004
Working radio w/ batteries	0.1191	0.0002
Christian	0.13	0.0023
Watched Television	0.141	<0.001
Understands Kerewe	0.198546	0.0408
Active mobile banking account	0.1992	<0.0001
Received advice from a community health worker	0.2272	0.0172
Received advice on maternal nutrition before pregnancy	0.2291	<0.0001
Lives in south region (Shinyanga, Geita, or Kigoma), not north region (Mwanza or Kagera)	0.237	<0.0001

The following variables were included in the analysis but did not demonstrate a significant association with early childhood nutrition knowledge and thus were not included or adjusted for in the final model:

- Caregiver's age
- Total number of children
- Number of children between 5 and 18 years-old,
- Youngest child's age
- Asset index
- Literacy
- Highest level of education achieved
- Marital status
- Ethnic group
- Language spoken on a daily basis,
- Understands English, Swahili, Haya, Sukuma, Kiha or Kisumbwa,
- Whether her household has a radio, television, mobile phone or computer,
- Whether she personally has a mobile phone or WhatsApp on her mobile phone,
- Whether she received advice on maternal nutrition before, during or immediately after pregnancy with her youngest child,
- Whether advice came from a health facility, feeding center staff, traditional healer, traditional birth attendant, pharmacist, religious leader, community leader, mother/mother-in-law, friend/neighbor, husband, TV, radio, mobile phone, newspaper, leaflet, poster or other source

analyses exploring factors associated with nutritional knowledge, after controlling for potential confounding variables. Insignificant variables were dropped from the final model by the model selection program ($\alpha > 0.05$). Caregivers from the more southern regions of Shinyanga, Geita, or Kigoma as opposed to the more northern regions of Kagera or Mwanza had higher levels of knowledge regarding early childhood nutrition. Receiving advice on maternal nutrition before pregnancy and from a community health worker were both associated with higher knowledge. To a lesser extent, using active mobile banking and understanding the Kerewe language were both positively associated with knowledge. Watching television recently, affiliating with a Christian religion, having a working radio with batteries, and having an increasing number of children under the age of 5 all demonstrated a significant positive association with increased knowledge. Variables that were negatively associated with knowledge included living in a rural setting and understanding the languages of Kihangaza or Kizinza.

DISCUSSION

The purpose of this study was to explore factors associated with knowledge of proper early childhood nutrition practices of female caregivers in Tanzania. Exposure to media and communication technology was related to knowledge of early childhood nutrition, particularly watching television. Almost one-fourth of respondents reported having not watched television recently, and very few had a television at home. Provided the low rate of ownership, watching television may be a social event as people must travel outside their home and interact with someone who owns a TV. Examples of this could include locations such as restaurants or local pubs where people go to watch television and to discuss what is being broadcast. It is possible that the social nature of TV watching results in some level of interpersonal exchange, which may then impact nutritional knowledge. As it relates to radio, ownership may be both a marker of wealth and a mechanism for increasing knowledge given the regional use of this medium for broadcasting public

health-related messages. This finding is consistent with other studies which demonstrated that access to radio media increases health knowledge [11, 12]. Future efforts to improve knowledge in Tanzania may benefit from a continued focus on radio. Consequently, increasing access to media in general could be one way to increase health knowledge among people in Tanzania.

In this study, numerous sociodemographic factors emerged as significant correlates of nutritional knowledge, including region of residence and urban density, language ability, and religious affiliation. The most protective characteristics included living in the southern regions of the study sample, residing in an urban setting, language comprehension of one of the prominent languages, and identifying as Christian. These findings highlight the sociodemographic disparities that exist in Tanzania and suggest that ongoing and future interventions should prioritize individuals that represent religious and linguistic minorities, as well as those who are vulnerable based on region.

Further research is needed to understand why the northern regions had lower levels of early childhood nutrition knowledge than the southern regions. This difference persisted in early childhood nutrition knowledge and region when controlling for socioeconomic status, media exposure, and urbanization. This suggests that future studies need to identify additional differences between the populations of these regions.

Christian faiths represented the majority religious identification (84.74%). Pairwise comparisons and multiple regression did not show a significant difference in early childhood nutrition knowledge between the minority non-Christian religions, including Islam. This trend has been seen in Australian and Chinese populations where minority ethnic and religious groups were less likely to seek or receive maternal care for a variety of reasons including accessibility, cultural appropriateness of services, and dominance by the majority groups in access to services [13, 14].

Findings related to receiving advice on maternal nutrition underscore the important role of traditional health education in developing settings. Participants who received advice before pregnancy and who received advice from a community health worker reported greater childhood nutrition knowledge. Community health workers can provide much needed support within rural communities and help to promote

healthy behaviors through education [15, 16]. Empowering community health workers to expand services to at-risk regions and vulnerable groups should be a priority [17].

Though simply providing education does not ensure behavior change, several prominent models and theories identify knowledge acquisition as a critical component of behavior change. For example, the Health Belief Model posits that people are more likely to adopt health behaviors when they accurately perceive the threat to their health and the benefits from adopting the behavior [18]. Similarly, Social Cognitive Theory is widely applied in health education for its emphasis on social influences and promoting knowledge as a construct in the behavior change process [18].

LIMITATIONS

The findings from this study should be interpreted in the context of its limitations. The data do not represent all of Tanzania, but rather represent five regions within the Lake Zone. Hence, it is difficult to make assumptions about an entire population based on one study sample. Rigorous sampling protocols were implemented in the current study, but future research in Tanzania could be improved with greater representation of the country's many regions. This effort might include expanding sampling to those who do not speak Kiswahili. Overall, language was a limitation in this study. The survey language was Kiswahili; however, many Tanzanians who reside in the survey regions primarily speak other local languages, especially those living in more rural settings.

Another potential limitation is that there could be confounders in unknown socioeconomic factors, other than those for which the study controlled. Such socioeconomic factors could have played a role in contributing to health knowledge. Although the research team implemented several methods of controlling for socioeconomic status, including land size and an asset index, these did not significantly affect the model. For this reason, it is difficult to rule out that part of the disparity in health knowledge was due to socioeconomic status.

CONCLUSION

Knowledge about proper early childhood nutrition practices is thought to influence positive nutrition-related behaviors in caregivers that are protective

against stunting. The purpose of this study was to examine the relationship between Tanzanian primary caregivers' knowledge of proper early childhood nutrition and other factors such as media exposure. The study found that exposure to media in the forms of television and radio were associated with greater nutritional knowledge. Future efforts in Tanzania to improve primary caregiver knowledge of childhood nutrition may be focused on specific and vulnerable populations, including those who speak minority languages, belong to minority religious groups, and live in rural settings. Community health workers would likely play a significant role in these efforts.

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