



A Mixed Method Research to Assess Drivers of Stunting in High Food Producing Areas in Tanzania - A Case Study of the Njombe Region

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Received Date: October 21, 2024; Published Date: November 13, 2024

Abstract

Childhood stunting is among the substantial obstacles to human development, affecting approximately 162 million children under the age of 5 globally. In Tanzania, approximately 34.8% of children below five years were stunted in 2015. Despite Njombe being a high food-producing region, it has the highest stunting rate (54%), exceeding 40%, considered very high by WHO. The study aimed to explain the specific drivers of stunting in the Njombe region to inform nutrition stakeholders and partners and formulate specific interventions. The study employed a mixed-methods approach by re-analyzing the 2015 Tanzania Demographic and Health Survey data and collecting primary qualitative data in three districts of the Njombe region. In-depth interviews were conducted with 31 regional and district implementers, and 22 Focus group discussions were done with parents of children aged <2 years, adolescent mothers, and older women. Logistic regression models were used to determine the association between the independent and dependent variables, and inductive and deductive approaches were used for qualitative data analysis. Low birth weight, age, sex of the child, gender of the household head, maternal height, wealth, parity, and maternal occupation were associated with childhood stunting ($p < 0.05$). Qualitative results indicate inadequate child care due to maternal workload, alcoholism, poor infants and young child feeding practices, poor access to health services, and poor hygiene and sanitation were associated with stunting. Several factors associated with stunting require community-based interventions tailored to parents with children under two years of age and to households to address all factors associated with stunting in the Njombe region. Additionally, launching community-based nutritional education programs and strengthening the community's economic level is essential to reduce the burden of stunting.

Keywords: Stunting; Drivers; Children Under Two Years; High Food Producing Area; Njombe; Tanzania

Abbreviations

ANC: Antenatal Natal Clinic; CHW: Community Health Workers; DC: District Council; DFID: Department for

International Development; DRCHCO: District Reproductive and Child Health Coordinator; ECD: Early Childhood Education & Development; FGD's: Focus Group Discussions; IDIs: In-depth interviews; IHI: Ifakara Health Institute; NBS:

National Bureau of Statistics; RRCHCO: Region Reproductive and Child Health Coordinator; TC: Town Council; TDHS: Tanzania Demographic and Health Survey; UNICEF: United Nations Children's Fund; WASH: Water, Sanitation, and Hygiene; WHO: World Health Organization

Introduction

Childhood stunting is one of the substantial obstacles to human development globally, affecting approximately 149 million children under the age of 5 years in 2020 [1]. More than half (53%) of all under five stunted children live in Asia, and two out of five (41%) live in Africa [1]. Although stunting has declined steadily since 2000, from 33% to 22% in 2020, faster progress is needed to reach the 2030 target. The latest joint malnutrition estimate analysis indicates that only one-quarter of all countries are on track to halve the number of children affected by stunting by 2030, while not being possible for another quarter of countries.

Several factors are known to cause stunting among children in developing countries, including poor socio-economic status, maternal level of education, maternal occupation, household income, and health expenditure [2,3]. Additionally, micronutrient deficiencies, inadequate protein intake, and infections may cause stunting [4]. However, most determinants were from the re-analysis of Demographic and Health Surveys [5], seeking to associate socio-demographic information with stunting but with limited qualitative information on community understanding, perception, and context-specific drivers. Stunting has a long-term effect on individuals and societies, including diminished cognitive and physical development, reduced productive capacity and poor health, and an increased risk of degenerative diseases such as diabetes [6,7].

In Tanzania, approximately 34.8% of children below five years were stunted in 2015 [8], and 32% were stunted in 2018 [9], which is still considered high according to the World Health Organization (WHO) classification. Greater efforts are thus required to decrease the prevalence of stunting among children in Tanzanian [8,9]. Furthermore, Tanzania has limited findings on determinants of stunting, particularly in high crop-producing areas [10]. Njombe region has the highest rate of stunting (54%) in 2018 [8], which is considered a very high malnutrition rate as per WHO classification [11]. The region is considered a food basket region with Irish potatoes, maize, paddy, legumes, fruits, and vegetables commonly grown in this area [12]. From this background, we assessed the drivers of high rates of stunting in children under two years in the Njombe region of Tanzania using a mixed-methods approach to inform program implementation.

Materials and Methods

Study setting

The study was conducted in the Njombe region in three districts, including Njombe Town Council (Njombe TC), which included Njoomlole and Itulike villages; Wanging'ombe district (Igwachanya and Banawanu villages) as well as Ludewa district (Ludewa and Lupanga villages). Njombe region, despite being a high crop-producing area and a region that receives donor support to implement stunting reduction programs, stunting has been persistently high, calling for more research.

Department of Fund International Development (DFID), currently known as FCDO, has been supporting UNICEF and other partners to implement integrated nutrition interventions to reduce stunting, a project known as Addressing Stunting in Tanzania Early (ASTUTE). The project utilized a Social Behavioural Change Communication (SBCC) approach to change behavior around Infant and young child feeding, Early Childhood Development (ECD), Water Sanitation and Hygiene (WASH), and gender with an emphasis on male involvement. This five-year project was implemented in nine regions of Tanzania's Mainland, including Njombe. However, the stunting rate remains high instead of being significantly reduced, which decreased from 52% in 2010 [13] to 49% in 2015-16 [8] and rising again to 50% in 2022 [14].

Study Design

The project utilized a mixed-methods approach using secondary quantitative data analysis and primary qualitative data collection. The qualitative data collection was done to enrich information generated from secondary data. The mixed-methods approach is thought to provide more comprehensive information on drivers attributed to stunting than a single cross-sectional survey.

Data Collection

Secondary Quantitative Data

The study used the Tanzania Demographic and Health Survey (DHS) data for 2015-2016. The survey is usually done using a nationally representative sample of households every five years to generate national and regional-specific estimates of standard demographic and health indicators. It uses standardized data collection instruments and has four main questionnaires: women and men questionnaires, household questionnaires, and biomarker questionnaires [8]. For this analysis, data on the household and women's questionnaires from the Njombe region was used. The analysis included several indicators related to household socioeconomic status, such as maternal use of Antenatal care (ANC) services,

maternal and infant feeding, childhood infections, maternal and infant anthropometric measurements, and fertility rate. A total of 406 households were visited in Njombe during the 2015/2016 DHS. Of these, 310 were located in rural areas and 96 from urban settings as per the National Bureau of Statistics (NBS) rural-urban categorization. In the surveyed households, 359 women were interviewed and anthropometric measurements were taken for 208 children.

Qualitative Data

In-depth Interviews and focus group discussions: Data were collected in January and February 2020 covering the three districts of the Njombe region. The in-depth interviews (IDIs) were conducted with stakeholders in nutrition, education, livelihood, and social protection at regional, district, and community levels. In total, 31 government officials were interviewed: four from the regional level, ten from Njombe TC, nine from Wanging'ombe, and the remaining eight from Ludewa district council.

Furthermore, the Focus Group Discussions (FGDs) were conducted in the three districts, and two villages were selected for each district. In each village, four FGDs were conducted with four groups; mothers and fathers with children under two years, adolescent mothers, and older women. Focus group discussions (FGDs) were conducted with each group separately. A total of 22 FGDs were conducted, six for each group (Mothers of children under 2 years, fathers with children under 2 years old, Elderly women) and two with adolescent mothers. Each FGD group had a minimum of six people and a maximum of twelve participants. Adolescent mothers were difficult to find, and therefore, the targeted number of two FGDs was not attained in Njombe TC and Wanging'ombe DC.

Study populations were purposefully selected, followed by randomly selecting the desired number to participate in these groups. Inclusion criteria were having an under-two-year-old child or being 55 years old for older women and providing written consent. For adolescents, consent forms were signed by parents or witnesses. During the focus group discussion, the participants were given numbers (1, 2, 3,

4....12) to avoid capturing their identification. The main aim was understanding knowledge, beliefs, perceptions, and attitudes about stunting.

Data Analysis

Quantitative Data

Frequencies and proportions of the selected households, maternal and child indicators were stratified by areas of residence (Rural/Urban). Logistic regression models were used to study the association between selected household, maternal, and child indicators with stunting. Multivariate analysis results were not presented since the confidence intervals were too wide for any meaningful conclusion due to the small sample size. Stata version 14 software was used for qualitative analysis.

Qualitative Data

Qualitative data were transcribed verbatim. Data were analyzed, focusing on emerging themes, patterns, similarities, and differences to produce a framework matrix. Open coding was used to label concepts, defining and developing categories based on properties and dimensions of participants' descriptions. Both the inductive approach (ideas emanating from the data itself) and the deductive approach (theoretical understanding, literature review, and researcher's experience) were used for data analysis. Analysis was performed using Nvivo version 12.

Results and Discussion

Results

Household's demographic characteristics

Most of the visited households were male-headed and had less than five family members. Sixty-two percent of the surveyed households reported having three meals per day. Nearly six out of every 10 households visited reported not having a problem with food in the past month (Table 1). Sixty percent of the surveyed households had access to an improved water source. A third of the population in Njombe is in the second richest wealth quantile group.

	Njombe					
	Rural		Urban		Total	
Overall	310 (76.4)		96 (23.7)		406	
Headship of the households	N	%	N	%	N	%
Male	220	70.9	71	74.0	291	71.7
Female	90	29.1	25	26.0	115	28.3
Family size						
Less than 5	180	58.1	48	50	228	56.2

5 and above	130	41.9	48	40	178	43.8
Household food security The usual number of meals per day						
1 meal	6	1.9	0	0.0	6	1.5
2 Meal	132	42.6	16	16.7	148	36.5
3+ meal	172	55.5	80	83.3	252	62.0
Frequency of problems satisfying food needs in the past month						
Never	213	68.7	87	90.6	300	73.9
Seldom	73	23.6	8	8.3	81	20.0
Sometimes	18	5.8	1	1.0	19	4.7
Often	5	1.6	0	0.0	5	1.2
Always	1	0.3	0	0.0	1	0.3
Access to drinking water and a toilet						
Improved	167	53.9	85	88.5	252	62.1
Unimproved	143	46.1	11	11.5	154	37.9
Wealth quintile						
Poorest	35	11.3	0	0.0	35	8.6
Second poorest	68	21.9	1	1.0	69	17.0
Middle	114	36.8	3	3.1	117	28.8
Second richest	91	29.4	39	40.6	130	32.0
Richest	2	0.7	53	55.2	55	13.6

Table 1: Household demographic characteristics in the Njombe region (N=406).

N- Total Sample size; %-Percentage

Determinants of stunting from quantitative data Household and Maternal factors

The household head was significantly associated with child stunting, whereby households headed by a female had reduced odds of stunting (OR=0.48, 95% CI: 0.23-0.78). Another determinant was family size; as family size increases, the odds of having a stunted child increase by 76%. Further, wealth quintile was significantly associated with stunting ($p=0.006$). Those in higher wealth quintile appeared to have reduced odds of having stunted children. Also, the height of

the mother was significantly associated with stunting. For a one-centimeter increase in the mother's height, the odds of having a stunted child decrease by 7% (OR=0.93, 95% CI: 0.88-0.97). Furthermore, as the number of mothers' live children increased, the odds of having a stunted child also increased. Mothers with 5-8 children had 2.33 times the odds of having a stunted child when compared to those with 1 or 2 children. Also, women working in agriculture activities had increased odds of having stunted children. The summary is given in Table 2.

Household characteristics	N	n	%	Crude OR (95% CI)	P values
Headship of the households					
Male	168	89	52.9	1	0.040*
Female	40	14	35.0	0.48 (0.23-0.78)	
Family size					
Less than 5	56	22	39.3	1	0.072
5 and above	152	81	53.3	1.76 (0.94-3.29)	
Place of residence					
Urban	52	27	51.9	1	0.689
Rural	156	76	48.7	0.88 (0.47-1.65)	

Wealth quintile					
Poorest	17	9	52.9	1	0.747
Second poorest	39	21	53.9	1.0 (0.33-3.25)	
Middle	54	29	53.7	1.0 (0.35-3.07)	
Second richest	66	31	47.0	0.79 (0.27-2.29)	
Richest	32	13	40.6	0.61 (0.18-1.99)	
Access to drinking water and a toilet					
Unimproved	84	38	45.2	1	0.235
Improved	124	65	52.4	1.33 (0.77-2.32)	
Age of mother					
15-19	5	1	20.0	1	0.417
20-24	41	19	46.3	3.45(0.3533.62)	
25-29	60	28	46.7	3.50(0.3733.18)	
30-34	53	27	50.9	4.15(0.4339.67)	
35-39	29	19	65.5	7.60(0.7577.43)	
40-44	15	6	40.0	2.67(0.2330.07)	
45-49	5	3	60.0	6.0(0.3510.57)	
Highest level of education					
No Education	12	7	58.3	1	0.313
Primary	163	85	52.2	0.78 (0.24-2.55)	
Secondary	29	11	37.9	0.44 (0.11-1.72)	
Higher	4	0	0.0	-	
Number of living children					
1-2	80	31	38.8	1	0.039*
3-4	76	41	54.0	1.85 (0.97-3.50)	
5-8	52	31	59.6	2.33 (1.40-3.99)	
Mother Employment status					
Not employed	5	2	40.0	1	0.7637
Non-agricultural work	54	25	46.3	1.29 (0.20-8.36)	
Agriculture work	149	76	51.0	1.56 (0.25-9.62)	
Mothers' height	208			0.93 (0.88-0.97)	0.003*
Mother BMI					
Thin (<18.5)	6	2	33.3	1	0.350
Normal (18.5-24.9)	149	71	47.7	1.82(0.3210.24)	
Overweight (25.0-29.9)	37	23	62.2	3.29(0.5320.34)	
Obese (≥30.0)	15	7	46.7	1.75(0.2412.64)	
Mother anemia					
Moderate	7	4	57.1	1	0.899
Mild	48	23	47.9	0.69 (13.9-3.42)	
Not anemic	153	49.7	49.7	0.74 (0.16-3.42)	

Table 2: Prevalence of stunting in a child under five by household characteristics.

*Significant at $P \leq 0.05$; N- Total Sample size; n- Sample size; OR- Odd Ratio; CI- Confidence Interval; %-Percentage

Child factors contributing to stunting

A total of 208 children were recruited from 406 households visited in Njombe during the 2015/2016 household survey, 156 (75%) in rural and 52 (25%) from urban settings. The prevalence of stunting was 49.5% at the regional level. When stratified by area of residence, urban settings had a bit higher prevalence of stunted children (51.9%) compared to rural settings (48.7%). There was no clear pattern in

the prevalence of stunting by order of childbirth. Children born with low birth weight were more likely to be stunted (70%) compared to those born with normal or larger weight (49.4%). The prevalence of stunting was higher (61%) in older children compared to younger children. Boys were more stunted (51.4%) than girls (46.3 %) in rural settings but overall, the prevalence was very similar (Table 3).

	Rural(N=156)		Urban(N=52)		Total (N=208)		OR (95% CI)	P-value
	n	%	n	%	n	%		
Overall	76	48.7	27	51.9	103	49.5		
Child characteristics								
Birth order								
First	15	45.5	6	46.2	21	45.7	1	0.018*
Second	6	21.4	6	50.0	12	30.0	0.51(0.20-1.20)	
Third	16	64.0	7	58.3	23	62.2	1.96 (0.81-4.72)	
Fourth and above	39	55.7	8	53.3	47	55.3	1.47 (0.72-3.02)	
Size at the time of birth								
Average or larger	63	49.6	24	49.0	87	49.4	1	0.218
Low birth weight (<2.5kg)	4	57.1	3	100	7	70.0	2.39 (0.60-9.5)	
Anemia								
Moderate	17	60.7	2	40.0	19	57.6	1	0.268
Mild	14	41.2	2	40.0	16	41.0	0.51 (0.20-1.31)	
Not Anemic	41	50.0	23	63.9	64	54.7	0.89 (0.41-1.94)	
Age of child								
Less than 6 months	4	30.1	0	0.0	4	21.1	1.6 (0.31-8.30)	<0.001*
6-11 months	3	20.0	0	0.0	3	14.3	1	
12-23 months	15	48.4	6	54.6	21	50.0	6.0 (1.53-23.46)	
25-49 months	40	54.8	21	77.8	61	61.0	9.38 (2.59-33.98)	
Sex of child								
Boys	38	51.4	12	41.4	50	48.5	1	0.781
Girls	38	46.3	15	65.2	53	50.5	1.08 (0.64-1.38)	

Table 3: Prevalence of stunting in a child under five by child characteristics (N=208).

*Significant at $P \leq 0.05$; N- Total Sample size; n- Sample size; OR- Odd Ratio; CI- Confidence Interval; %-Percentage

Determinants of stunting from qualitative data

In-depth interviews included Regional and District nutrition, agriculture, education, planning officers, and Reproductive and Child Health Coordinators (RCHCO). Furthermore, community development officers and Community Health Workers (CHW) were also interviewed. In total, 31 interviews were conducted across all study settings. Furthermore, a total of 22 FGDs were conducted. Each FGD group had a maximum of six to twelve respondents, and therefore, on average, the study had 225 participants who were interviewed.

Several social-economic and environmental factors were generated during IDIs and FGDs. The social factors were inadequate knowledge about stunting and its causes, women's workload and lack of childcare facilities, Poor access to healthcare services during pregnancy, Domestic-based violence and divorce, alcohol consumption, low women's participation in decision-making concerning foods, low-quality edible food availability and use, poor eating habits during pregnancy, Delayed breastfeeding initiation and exposure to the pacifier, and inadequate child food diversification. Environmental factors were Poor Water,

Hygiene, and Sanitation (WASH).

- **Inadequate knowledge about stunting and its causes**

Almost all of the respondents were viewing stunting from the perspective of severe acute malnutrition. None of them were able to visualize that being short was a nutrition problem. The majority felt that stunting is a genetic problem and the community could do nothing about it. Few participants related stunting with a lack of a balanced diet to children under two years of age; however, they could not directly link the effect of eating a balanced meal with stunting. Some of the respondents perceived stunting to be associated with eating cold foods and wrong feeding time, and few mentioned that the problem does not exist in their community.

- **Some respondent quotes**

Stunting is caused by feeding a child cold food early in the morning. A child who is fed cold food in the morning is likely to be stunted" (Wanging'ombe_Banawanu_FGD_adolescent mothers).

Stunting occurs when parents fail to give their children a balanced meal on time. You might find that a mother does not feed a child in the morning up until late afternoon when she cooks ugali. This clearly will cause stunting since the feeding timetable is not clear" (Ludewa Ludewa_FGD_mothers with children under two years).

Stunting is genetic and nothing we can do to reduce it. Previously we had many cases of children with wasting and now is declining. People have received enough nutrition education; therefore, we do not have malnourished children" (Njombe Itulike_FGD_mothers with children under two years).

- **Women's workload and lack of childcare facilities.**

Economic activities were similar across the study settings. These included agriculture and small business regardless of the geographical location of the study setting (urban or rural). Agriculture included the cultivation of food and cash crops, including maize, beans, paddy, wheat, sunflower, fruits, and vegetables. Business activities also involved the selling of food crops. Men and women practiced both economic activities where women were more engaged in agricultural activities while the majority of men were engaged in business. The heavy workload, coupled with the lack of a child care unit, compromised care services for children under-fives. The commonly mentioned effect of women's involvement in economic activities on the well-being of children was the lack of time to prepare a diversified diet and feed the child on time. When the mother spent many hours in economic activities, children were mostly fed leftovers that were cold throughout the day.

There are a lot of activities we father escape and we do not participate as required, for example, farming and gardening are mostly done by women" (Njombe TC_Itulike Amani_FGD_fathers with children under two years). Since women are involved more in agriculture and economic activities, they may leave home very early and leave the child with their older siblings, so the child lacks recommended meals in a day and they are given leftovers" (Nutrition Officer_District 2).

- **Poor access to healthcare services during pregnancy**

Some respondents pointed out that it was hard for them to access healthcare services during pregnancy since they lived far from healthcare facilities or were unable to cover medical examination charges. Moreover, some of the women had to hire a motorcycle or a car to reach the healthcare centers. Subsequently, some women missed antenatal visits and services offered because they were not able to pay for the travel costs as said:

It is difficult for some pregnant women to walk for about seven kilometers, especially those from Ibihi and Lusanjo areas. These areas are very far from the dispensary; therefore, it might take a long time to walk unless they hire a motorcycle or a car. This is because of the geographical location of our village" (Ludewa Ludewa_FGD_fathers with children under two years).

With regards to health services, they are doing well but the problem is financial charges. They charge us for the medical examinations. Sometimes women are afraid to go for ANC visits because of the charges for a medical examination that may sometimes amount to fifteen thousand TZS. Our income is very low, we have children to take to school and many things. We are not attending ANC if we don't have that amount of money even if it's time for your visit. You have to wait until you get that money" (Wanging'ombe_Igwachanya_FGD_mothers with children under two years).

- **Domestic-based violence and divorce**

Different types of domestic violence were reported similarly across all settings, whereby women and children were the most vulnerable. Types of domestic violence include physical, emotional, and psychological violence. Most practiced violence was physical, which included the excessive beating of women and children and, in a few incidences, resulted in death. Women's domestic violence was found to be practiced by husbands, while child domestic violence involved parents and other close family members such as brothers, sisters, uncles, and aunts. Domestic violence, particularly among children, occurred when a child felt hungry and ate some of the food that was reserved for either afternoon or evening meals and other reasons. Also, domestic violence was said to be associated with stunting as it might end in divorce and substantially affects child-feeding practices.

There are different kinds of domestic violence, for example, physical violence, which is mostly practiced. Also, there is a family abandonment where women and children are vulnerable. Few cases of killings of children and adults have been reported" (Community Development officer District 3). The parent can beat the child just because he/she felt hungry and ate food that was reserved for dinner" (Wanging'ombe_Igwachanya_FGD_fathers with children under two years).

When violence occurs, the mother may decide to leave and abandon the children with no possibility for the father to cook and care for them. The mother is responsible for child care in the household and not the father" (Ludewa_CHW).

- **Alcohol consumption**

This study found that alcohol was highly consumed in the Njombe Region. The most common type of local alcohol consumed was that made of maize, locally known as Komoni. and the alcohol obtained from bamboo trees, known as Ulanzi." It was reported that alcoholism strongly contributes to different forms of malnutrition including childhood stunting in several ways. Pregnant women claimed to take a lot of alcohol during the early gestation of pregnancy till the late months of gestation (seven months) when they started consuming healthy foods. In addition, caring and feeding practices for children were said to be hindered when both parents are heavy drinkers and no one is left to take care of children. Alcoholism has not only been said to have a negative bearing on complementary feeding but also on breastfeeding, as a drunk woman cannot breastfeed timely and sometimes gives alcohol to a child.

Alcoholism is a problem even in lactating women who would consume alcohol and feed it to their small children. This practice is perceived as normal since individuals have grown up seeing their parents doing so and therefore, they also tend to drink and give to young children (Nutrition officer_District1)

Alcoholism has not only had a negative bearing on complementary feeding but also on breastfeeding. This was observed when a breastfeeding woman got drunk, she could hardly remember to breastfeed timely hence a decrease in the production of breast milk" (Wanging'ombe_Igwachanya_FGD_mothers with children under two years)

Some women once they are pregnant, they drink alcohol. Some pregnant women might consume up to one liter of local alcohol in a day. She might drink for the whole week. Some usually stop consuming alcohol when the pregnancies reach seven months. It is when they try to consume healthy foods like stiff porridge, meat, and vegetables" (Njombe TC_Itulike_FGD_Elder women).

- **Low women's participation in decision-making concerning foods**

The study found that fathers were the main decision-makers even in matters of the type of foods to be cooked in the household especially foods of animal origins. If the household had chickens, the mother was not allowed to slaughter the chicken for food without the father's permission.

Father has a final say in the matters pertaining to household and this is why it is imperative to educate fathers to have a good understanding of nutrition issues because he can decide on issues like slaughtering a chicken for food. No single mother can decide on her own to slaughter a chicken" (Nutrition officer_District 1).

- **Low-quality of edible food availability and use**

Njombe region is the major maize producer in the country, but also a producer of legumes and fruits. The cultivated food serves as food at the household level but also as a means of income through selling. It was reported that some people sell all their cultivated food and remain with nothing, while others would sell and remain with small, low-quality quantities, which would not suffice until the next season. Moreover, most of the income obtained after selling the produce was not channeled to purchasing more nutrient-dense food but rather to purchasing alcohol or paying school fees. This, in turn, creates a cycle where people would sell food to obtain money for alcohol, and when they run out of money, they would sell the little remaining food at the household, leaving their families with nothing. The problem of aflatoxin in maize was also reported in the Njombe during the in-depth interviews and was linked with poor child nutrition status as consumption of maize with aflatoxin may cause child growth retardation.

Some people would sort the high-quality maize, which they would sell at a high price, while the rotten low-quality maize would be used for household consumption. We continue to insist that people should keep a reserve of some quality food for household consumption and sell some" (Nutrition Officer-District 1)."

Each household has all food groups available including starchy foods, sugary foods, and fruits; however, the problem is people decide to sell food to pay child school fees; hence, they struggle to obtain food to feed their families later" (Wanging'ombe_Igwachanya_FGD_Adolescent Mothers).

Let me be honest, we have a lot of food but the problem is we sell and buy alcohol or pay school fees hence we struggle to obtain food to feed our families" (Njombe TC-FGD_Fathers with children under two years)

When aflatoxin reaches a certain level in food, it kills, it may affect the child's growth, and this has been scientifically proved. We don't have an incidence that people are affected

by aflatoxin in our area but we used to see the aflatoxin in our normal environment” (Agriculture Officer District 1)

- **Delayed breastfeeding initiation and exposure to pacifier**

Almost all respondents knew that they needed to initiate breastfeeding immediately after delivery (within one hour as recommended by WHO). However, early breastfeeding initiation was reported to be affected by childbirth type (i.e. natural birth or cesarean section), place of delivery (i.e. at home or in a health facility), maternal health, premature birth, as well as newborn response soon after delivery. Delay in breastfeeding initiation was more prominent in women who gave birth by cesarean section, those who delivered on the way to the healthcare facility as well as mothers whose babies were quite soon after being born or whose mother had a medical condition.

It all depends on the newborn. Other newborns are quiet and sleep after birth, allowing the mother to even take a shower; however, others do cry immediately after birth, and therefore, you breastfeed first before taking a shower” (Wanging’ombe Igwachanya_FGD_mothers with children under two years).

I initiated breastfeeding after almost four hours even though I naturally gave birth. If I had a cesarean surgery it might have taken even more than ten hours since the mother has to rest. During this time when we wait for the mother to regain her energy, the newborn is usually fed some drops of water”. If it takes a longer time for the mother to stabilize, I give the child water and sugar” (Njombe TC Njoomlolo_women with children under two years).

If the newborn is not premature, breastfeeding initiation is immediate. However, if the baby is premature, it is usually kept in an incubator; therefore, the mother has to wait for more than one hour before initiating breastfeeding (Wanging’ombe_ Igwachanya_FGD_Adolescent mothers).

Women who give birth at the healthcare facility initiate breastfeeding within one hour after delivery, however, women who give birth before reaching the healthcare facility or home initiate breastfeeding at least after two hours” (DRCHO_District 1).

- **Non-exclusive breastfeeding**

During the focus group discussions, the majority of the respondents were well informed that mother’s milk is the only food recommended for a child under six months of age. They admitted that healthcare providers provide such advice when they visit the health facility. However, women’s knowledge of exclusive breastfeeding was higher compared to men. Male respondents, especially from Wanging’ombe, said that the recommended food for children under six

months was porridge and some claimed to be advised by health professionals. Respondents from Itulike claimed that a child under six months could be given other kinds of milk than breast milk, for example, cow milk if the mother has some health issues or has passed away.

A child should only be breastfed for the first six months because mother’s milk is the foundation in preventing diseases”. It’s after six months when the child is introduced to complementary foods” (Wanging’ombe_Igwachanya_CHW).

A child under six months should be fed thin refined maize porridge that contains margarine” (Wanging’ombe Igwachanya_FGD_Fathers with children under two years).

A nurse told me not to feed my child mixed grain porridge (unga wa lishe) if the child is under six months; instead, I should give plain maize porridge” (Wanging’ombe Igwachanya_FGD_Fathers with children under two years).

A child might be fed some other kinds of foods even when he has zero months or three days mainly due to some special reasons. For example, if a mother has a big health problem and cannot breastfeed or if she passed away, alternatively the child may be given cow’s milk” (Njombe TC_Itulike_ FGD_ Fathers with children under two years).

Findings also indicated that despite some women having enough knowledge about exclusive breastfeeding very few practiced it and claimed that it was too hard to practice. One of the reasons for not practicing exclusive breastfeeding is the negative perception when a child with less than six months cries too much, indicating a sense of being hungry. Crying too much was translated as a mother’s milk not enough to relieve a baby’s hunger or the mother’s milk was watery.

Let us be honest, we can’t. Personally, I was not able to exclusively breastfeed my children for six months. I tried, but I failed; I fed them porridge once they reached three months because it was so challenging, and the child was crying excessively. I, therefore, realized that my milk was not enough, it was watery, I started feeding the child some thin porridge” (Wanging’ombe Igwachanya_FGD_mothers with children under two years).

In our community, normally, children are born hungry. When the child reaches two or three months, we prepare a thin and smooth porridge and give the child a small amount. Others give the child four or five spoons of porridge or water, saying that a child was born hungry as they cry too much” (Njombe TC_Itulike Amani_FGD_Fathers with children under two years).

It is recommended to feed the child nothing apart from breast milk. We violet this because sometimes the child is either very hungry or the breast milk is not enough. You may give a child some porridge. (Wanging’ombe_Igwachanya_FGD_Adolescent Mothers).

- **Inadequate Child Food Diversification**

Poor complementary feeding was observed in children six months and above, whereby most of the mothers fed their children porridge as the main food for the whole day. The porridge was either of maize or mixed grains and nuts or beans e.g. mixing millet, sorghum rice, groundnuts, soya beans, etc. The community members believed that porridge with mixed grains (unga wa lishe) contains all the necessary nutrients required by the child to grow optimally. Some members informed that mothers or other family members were not concerned about the nutrients the children get from food but only made sure that the child's stomach was full. Other interviewed members reported not having time to prepare a diversified meal due to little time.

The child can get all the required nutrients from the porridge with mixed grains and nuts. For example, we mix maize, wheat, and rice. The porridge is also mixed with groundnuts so the child can get fat. We also add milk for protein sometimes" (Njombe Njoomlole_FGD_women with children under 2 years).

As parents, we only care that the child's stomach is full, we do not care about the nutrients" (Ludewa_FGD_Mothers with children under two years) There are no special meals for children, they are fed normal meals that are consumed by the whole family like stiff porridge, rice, etc. Apart from that, they are fed porridge" (Nutrition Officer_District 2)

We are very busy with farming activities that usually interfere with child feeding. As a result, the child eats just as an older person while he/she needs to eat frequently" (Njombe TC Njoomlole_FGD_women with children under two years).

It's true we love work more than our children. We are not following feeding timetables for our children. Even if we went to the farm most of the time, we do not pack food. We only focus on farming and not on the children's food" Njombe Itulike_FGD_women with children under two years).

- **Poor Water, Hygiene and Sanitation (WASH)**

Water sources in the Njombe region include water from taps and wells. The main water source in the urban areas was tap water and water from wells and rivers in the villages. As per the district council, the majority of the people use water from wells and rivers. It was reported that the Njombe council has three wards in town that have access to tap water while the remaining eight wards in the rural areas use water from the rivers and wells as their main sources. Although it was reported that water availability was not a problem in the region, some areas reported having water scarcity, for example, Igwachanya village in the Wanging'ombe district. Furthermore, despite the availability of tap water in some areas, the water was reported to be clean only during the

summer season and unclean water during the rainy season. A larger population uses water from wells where the water is hardly treated hence posing health risks to the community members. The majority reported drinking water from such sources without treatment and children were given the same water.

Water accessibility is not good in some hamlets; for Example, here in Igwachanya, water is a problem, we have two tanks, but water is still a problem, especially in July before the rainy season. During the rainy season, dirty water comes from the pump" (Wanging'ombe_Igwachanya_FGD_father with children under two years).

It is normal in most households to drink unboiled water. Very few people reported boiling drinking water. In most cases, water is left to settle before it can be used for drinking purposes. Some do not wait for the water to settle; they drink immediately after fetching it" (Wanging'ombe_Igwachanya_FGD_Adolescent Mothers).

Data collected on toilet availability showed that at least every household has a toilet. The toilet type was either a pit latrine or a flush toilet. The majority of the community members used pit latrines while only a few with good income used flush toilets as said:

Every house has a toilet. We have no house that lacks a toilet. The difference is unimproved pit latrines are many compared to flush toilets. (Njombe TC_Itulike Amani_FGD_Fathers with children under two years).

Apart from the availability of toilets, most of the households reported having rubbish pits. The mechanism of waste disposal in towns was different from that in the villages where there were designated trucks to collect wastes and transport them to the dumping areas in urban and not in the villages. The construction of pits for waste disposal was only applied in rural areas.

Each household has a rubbish pit; we investigate every household after every three months" (CHW_District 1).

Here in town, I think there is a truck that collects garbage. Households collect their garbage alongside the road, where trucks pick them up and transport them to the dump. Waste disposal here in town is good. It can be a challenge in villages because households are required to dig their pits" (Nutrition officer_District 1).

Discussion

This study aimed to identify the determinants of stunting in high crop-producing areas, specifically in Njombe region. Many factors were revealed to be associated with stunting

in under-five children during quantitative and qualitative data analysis. Factors were the gender of the household head, maternal height, low birth weight, age and sex of the children, birth order respectively, wealth, parity as well as maternal occupation. In the qualitative data analysis, the factors were inadequate knowledge about stunting and its causes, women's workload and lack of childcare facilities, poor access to healthcare services during pregnancy, domestic-based violence and divorce, alcohol consumption, low women's participation in decision-making concerning foods, low-quality of edible food available and use, delayed breastfeeding initiation and exposure to the pacifier, inadequate child food diversification and poor Water, Sanitation and Hygiene (WASH).

During secondary data analysis, the female-headed household had a reduced risk of having a stunted child. This might be due to the power women have in decision-making on food to be prepared in the household and the use of household resources. Studies have shown that an increased level of empowerment of the female caretaker improves child nutrition and health [15-17]. The result from this study contradicts many other studies that reported that children living in female-headed households were more stunted due to most females being widows and/or single mothers who lack key livelihood assets as well as their capacity to take up the financial burden within the household [18-21].

The odds of being stunted decreased with the increase in maternal height. Studies demonstrate that maternal short stature is an indication of poor maternal nutritional status and has strong associations with childhood stunting [22,23]. Children born by short mothers are more likely to suffer from intrauterine growth restriction (IUGR) and small-for-gestational-age (SGA) at birth [24-27]. This concurs with the result obtained by Addo et al. [28] which showed that one centimeter (cm) increase in maternal weight predicted a 0.024 (95% CI: 0.021-0.028) SD increase in offspring birth weight and 0.037 (95% CI: 0.033-0.040) SD increase in conditional height at the age of two years. In addition, a study conducted in Northern Ghana showed that a short mother (<150 cm) was more likely to have a stunted child [29]. Based on this result, the high rate of stunting in Njombe could probably be due to the cyclical nature of stunting [30], where stunted children grow to become stunted mothers who later give birth to low-birth-weight children who also become stunted.

A timely ANC visit was a problem in Njombe. Under Tanzania's focused antenatal care guidelines, pregnant women are supposed to attend a minimum of eight visits, for low-risk pregnancies and receive targeted interventions at each visit [31]. Adequate health services during pregnancy have a big contribution to positive birth outcomes [32]. Timely ANC visits enhance pregnant women to be supplemented with

both tablets and nutrition education as WHO recommends a daily intake of iron and folic acid (IFAS) during pregnancy, adequate dietary intake, and intermittent intake of anti-malaria drugs which protect the unborn child. Lacking these important services may affect the nutrition status of maternal and, consequently, child nutrition status because child stunting starts in the uterine [33]. The Tanzania demographic and health survey showed an increase in ANC visits reduces child malnutrition [8]. Despite ANC services being offered freely, some factors hinder ANC visits like distance to the health facility and unfriendly services [34].

Factors like women's engagement in social and economic activities and alcoholism were mentioned to prevent women from preparing a diversified diet and feeding timely. Women in Njombe were highly engaged in social-economic activities especially agriculture and small business. Spending many hours in economic activities contravened the feeding timetable and the quality of food cooked since children were left to eat leftovers for three days or more. The study conducted in Uganda found that children whose mothers were housewives showed a lesser prevalence of wasting and stunting as compared to mothers working outdoors [35].

In addition, maternal education was also reported to affect feeding practices and consequently lead to stunting as maternal with low education were not able to plan a balanced meal despite food availability. The re-analysis of the DHS data showed decreased odds of the child stunting with increased maternal education though the association was not statistically significant. This result concurs with that of Nayak [35] and Chirande [4], which reported a decreased risk of stunting as maternal education increased. To reduce or eradicate stunting, maternal education on feeding a diversified diet is very important [36]. Domestic violence was also mentioned as another determinant of child stunting. Physical, emotional, and psychological were common forms of violence in Njombe. This violence has effects on the physical and mental health and well-being of women and may influence their dietary practices, physical activity, and care for their children [37,38]. This was reported by studies conducted in India and Nigeria, which found that maternal experience of violence was associated with an increased likelihood of children's stunting, underweight, and wasting compared to those who did not face any spousal violence [39,40].

Additionally, alcoholism was strongly mentioned to affect the feeding practices in three ways, first, the drunk mothers were not able to prepare food for their children because they spent a lot of time in bars taking alcohol. Secondly, a drunk father or mother tends to sell household food to purchase alcohol, which leaves the household with no food. Thirdly, the child was given alcohol to calm them when their parents

were drinking at the bar. These findings are supported by a study conducted in Kenya, which found that the alcoholic household was poorer with a less diversified diet and had more underweight and stunted children compared to non-alcoholic households [41].

Birth weight and birth order were significant determinants of stunting. Children born with low birth weight had increased odds of being stunted. Low birth weight babies are often disadvantaged in terms of physical growth and are also more vulnerable to infections compared to children born with normal birth weight [42]. The result concurred with several other studies conducted in different places [20,35,43]. Third-born children and above had increased odds of being stunted. This could be because parents are more excited with firstborns and caring for them more irrespective of their sex, while the caring may start to fall when a child of the desired sex is met [44]. Also, it could be due to the increased number of dependents as the rate of stunting was observed to increase as household members increased. A study by Asfaw (2015) conducted in South Ethiopia reported that children whose mothers gave birth to more than four children had a higher risk of being stunted compared with children whose mothers gave birth to one child [45]. As the number of children increases in the household, the economic demand increases, limiting the ability to provide daily nutrition requirements for proper child growth and physical development [46]. Again, parents with many children commonly lack sufficient time to pay proper attention to the needs of each child.

Another determinant for stunting in Njombe was infant and young feeding practices, which include poor breastfeeding and complementary feeding. The Majority of the mothers claimed to initiate breastfeeding early, but others introduced it lately up to four hours. WHO recommends infants to be breastfed soon after delivery which is within the first one hour [47]. Early breastfeeding initiation provides newborns with breast milk containing a high concentration of nutrients and antibodies. Breastmilk provides immunity and protection from gastrointestinal diseases and other infections, and hence good growth. Delaying the initiation of breastfeeding is associated with an increased risk of infant mortality and obstructing nutritional status [48]. The study conducted in Ghana showed that delayed breastfeeding increased the risk of neonatal death by fourfold in children given milk-based fluids or solids in addition to breast milk as well as depriving the infants of the nutritional benefits of colostrum hindered optimal nutritional status of the newborn [49]. Not only initiation was a challenge but also exclusive breastfeeding for six months. The majority of the children in Njombe were breastfed exclusively for two to three months and were introduced to complementary foods. This is also supported by data from Tanzania DHS which showed that only 44.4% of children in Njombe were exclusively breastfed [8]. WHO

recommends exclusive breastfeeding for the first six months of life [50]. Breastmilk for the first six months is confirmed to provide the energy and nutrients required by an infant less than six months to obtain optimal growth. The early introduction of complementary foods before the age of six months can lead to the displacement of breast milk and increased risk of infections and, hence, stunting [51,52].

Despite the early introduction of complementary food, dietary diversity was another contributing factor to stunting. The majority of children aged less than six months and above six months were mostly fed maize flour porridge. The TDHS showed that the dietary diversity (children received 3 or 4+ food groups) in Njombe was a bit higher (34%) compared to the national average (26%) [8]. Although the percentage was said to be higher in the Njombe region, it is clear that the stated percentage is too low to avert stunting. The study conducted by Kulwa, et al. (2013) in central Tanzania and another by Badake (2014) in Kenya reported that dietary diversity was a problem and most children were fed staples which subsequently hindered nutrition status [53,54]. Apart from the undiversified diet, the number of meals was inadequate. Participants from the Njombe Region reported having plenty of food. Reasons identified for poor feeding practices included limited preparation time, selling high-quality crops, or selling food crops to buy alcohol. Existing food habits and feeding practices seem to be informed by widely shared norms and beliefs [55].

Water, hygiene, and sanitation (WASH) were also among the determinants of stunting. As per the district council interviews, the majority of the people used water from wells and rivers. Regardless of the water source, water treatment was not commonly practiced. Again, pit latrines were the dominant type of toilets and were dirt in most cases creating a possibility of contaminating water sources, foods, and the environment where children play. Unhygienic practices may lead to regular and persistent infections followed by growth retardation and eventually fatal outcomes [56]. This is because of enteric exposure to pathogens [57].

Conclusion

This study found that despite Njombe being a high crop-producing area, stunting was very high, with several determinants requiring multi-sectoral actions. Childhood stunting was associated with low birth weight, age and sex of the children, gender of the household head, maternal height, wealth, parity as well as maternal occupation. During qualitative data analysis, the factors were inadequate knowledge about stunting and its causes, women's workload and lack of childcare facilities, poor access to healthcare services during pregnancy, domestic-based violence and divorce, Alcohol consumption, low women's participation

in decision-making concerning foods, low-quality of edible food available and use, delayed breastfeeding initiation and exposure to the pacifier, inadequate child food diversification, poor Water, Sanitation and Hygiene (WASH). There is a need to continue providing nutrition and health education to the community, especially to mothers with younger children. The emphasis should be placed on feeding a diversified diet. Interventions aimed at integrating nutrition and Early Childhood Development (ECD) programs, reducing women's workload, alcohol consumption, and domestic violence, as well as empowering women to make decisions around food, will be of great value in Njombe.

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