

Factors Associated with Stunting among Children Aged 0 to 59 Months in Harare City, Zimbabwe

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Abstract: *Background:* Child malnutrition is a major public health problem in Zimbabwe and it has been one of the leading causes of morbidity and mortality in children under five years of age in the City of Harare.

Methods: An analytic cross sectional survey was conducted on 342 mothers – child pairs of children aged 0 – 59 months in Harare's suburbs between July and August 2014. The aim of the study was to identify factors associated with the high levels of stunting among children age 0 – 59 months. Bivariate and multivariate analyses were used to establish the risk factors for U5 years stunting.

Findings: A total of 29.2% of the children were stunted with (19.3% being moderately stunted and 9.9% severely stunted). More females (32.9%) were stunted compared to (25.9%) males. The main contributing factors for stunting among the children 0 - 59 months were found to be lack of mother's education adjusted pOR=0.49 (95%CI: 1.04-3.27); being unemployed pOR=1.22 (95%CI: 1.08-2.03); residing in high density suburbs pOR=2.14 (95%CI: 1.61-7.55); child ever being hospitalized pOR=1.04 (95%CI: 1.01-2.14); breastfed after > 1 hour after birth pOR=1.11 (95%CI: 1.09-1.80); complementary feeds < 6 months pOR=1.30 (95%CI: 1.17-2.21); low birth weight pOR=1.46 (95%CI: 1.29-3.51) and having a poor dietary diversity pOR=1.07 (95%CI: 1.01-1.84).

Conclusions: Lack of mother's education is the principal risk factor for stunting among the under five children in Harare exacerbated by unemployment of either the father or mother or relative, area of residence, feeding practices, birth weight, illness and infections and household dietary diversity.

Stunting is on the increase in Harare. The findings also revealed a high level of in-equalities in social determinants of health since stunting is related to socio-economic factors.

Recommendations: Any nutrition intervention has to use strategies that will comprehensively address the social determinants of health and improve the standard of living of households in the high density areas so as to have a ripple effect on the nutritional status of U5s

Keywords: Stunting, mother-child pair, risk factors, social determinants of health.

INTRODUCTION

Stunting is a nutritional problem that is deeply rooted in poverty and deprivation. Grantham [1] purports that stunting affects mainly developing countries. Globally, it is estimated that about 178 million children younger than 5 years of age are stunted, WHO [2]. It is estimated that 95% of malnourished people live in developing countries in Sub-Saharan Africa and South Central Asia, WHO [2].

According to WHO and UNICEF [2] an estimated 165 million below the age of five years were stunted translating to 26% of under- fives being stunted globally. The World Health Organization [2] classifies a child as stunted (chronically undernourished) if his or her height- for- age index is more than 2 standard deviations below the reference median. Children who

are 3 standard deviations below the reference median height-for-age are considered to be severely stunted, using the new World Health Organization [2] growth standards of 2006. Stunting is much more common than underweight (low weight-for-age) or wasting (low weight-for-height).

Southern Africa region as of 2010 had a 32.9% estimated prevalence of stunting compared to 45.3%, 39.4% and 21.9% for Eastern Africa, Central Africa and Northern Africa, respectively UNICEF [3].

BACKGROUND

Globally Zimbabwe appears on the map as being in the zone of 30.0 % to 39.9% in terms of estimates for country prevalence of stunting [4].

The classification system categorizes countries or regions as follows; low prevalence (rates less than 20%), medium prevalence (rates of 20-29.9%), high prevalence (rates of 30-39.9%) and very high prevalence countries with rate of 40% and above.

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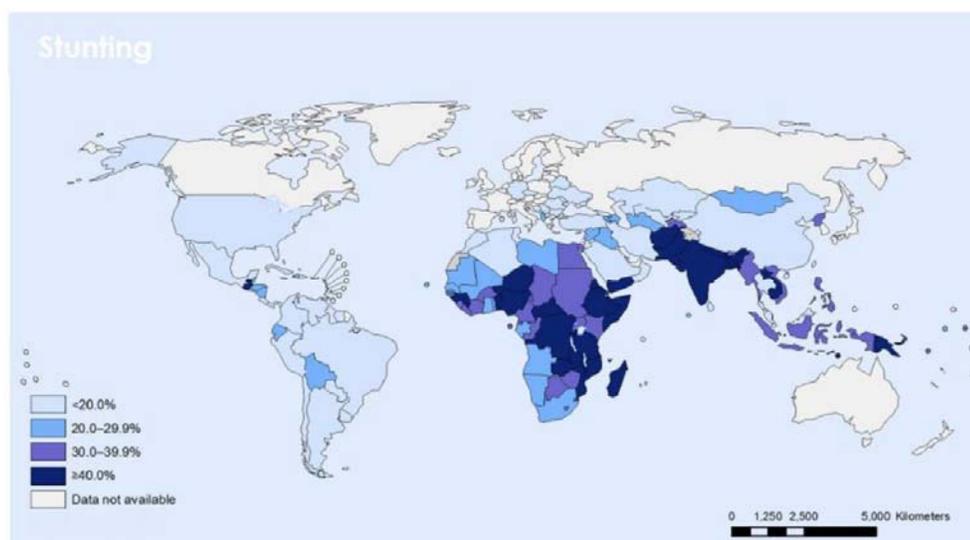


Figure 1: Global trend on the prevalence of stunting.

Source WHO UNICEF Country prevalence estimates 2012.

Furthermore the Food and Nutrition Council [5] survey indicates that boys were more likely to be malnourished than girls across all indices. In Zimbabwe the prevalence of stunting among children aged 0 – 59 months has increased over the years from 21% in the 1994 ZDHS [6] to 28% in the 2005/6 ZDHS [7] to the current 33.8% as indicated in the 2010/11 ZDHS [8].

The prevalence of children with a short stature in Harare as of 2010 was 28% (CI: 25.1 – 32.4), Food and Nutrition Council [5]. The ZDHS [8] 2010-11 indicates that the overall prevalence of stunting in Harare stands at 29% and that for severe stunting is 9.3%. According to the Zimbabwe National Nutrition Survey [9] of 2010 the percentage of children between 6 and 59 months of age classified as stunted is 28.7% against a target of below 2.3%. As a consequence approximately one in every three children aged 0-59 months in Harare is stunted.

According to UNICEF [3] Reports on nutrition, causes of stunting are multifaceted and multidimensional and include poor complementary feeding as well as not exclusively breast feeding children.

In Harare the City Health Department's mortality patterns indicate that over 40% of children under 5 years who die have malnutrition as an underlying cause. Thus malnutrition is the 4th cause of death among the < 24 months age group and 3rd leading cause of death among the <5 age group. Stunting increased over the years from 2007 to 2011 in Harare, with a year on year increment in its prevalence (Harare

City Health Department annual reports, 2007 – 2011) [10].

Against this background we therefore set out to undertake a study so as to explore the possible risk factors that determine chronic malnutrition among children under 5 years of age in Harare City during the year 2014.

Social determinants of health are factors that can determine the health outcome of households and communities in both negative and positive terms. Social determinants are also responsible for exacerbating inequalities in society and the inequalities further decrease chances of individuals to attain health. Various studies for U5 nutrition in developing countries have identified that child malnutrition is related to these inequalities.

Mandrefo *et al.* [11] carried out a community based cross sectional survey to determine risk factors and the prevalence of malnutrition among 796 children 6-59 months paired with care-givers in Ethiopia. Their findings indicate that underweight was significantly associated with having more than 4 children born to the mother, poor education of the father, and having had diarrhoea in the past 2 weeks. Not practicing family planning and time of commencing complementary feeding were related to wasting.

Ngianga-Bakwin Kandala *et al.* [12] investigated the impact of geographical setting on the nutritional status of children U5 in the Democratic Republic of Congo using data from a national household representative

sample. Their methods of analysis enabled them to examine geographical variation of the nutritional status of U5. They were also able to determine the extent to which the geographical pattern is influenced by other factors such as socio economic factors, and soft but volatile issues such as political, environmental, conflicts and cultural factors. In the end their analysis showed that malnutrition was present in all the provinces but it was more marked in rural areas

Tishome *et al.* [13] conducted a cross sectional study to identify the determinants of stunting focusing on food surplus areas in Ethiopia so as to identify the differential impact of other determinants such as demographics and psychographics and health factors. Factors related to malnutrition included the sex of the child, diarrhoeal episode, age at introducing complementary feeding and duration of breastfeeding.

Zere and D. McIntyre [14] analyzed data from the Standards and Development Survey from a sample of 3755 under five children so as to assess the burden of socio economic inequalities against under- five (U5) malnutrition in South Africa. Household income was used as a proxy indicator for economic status. The different types of malnutrition were calculated using the illness concentration index. Stunting was found to be concentrated in the Eastern Cape and Northern provinces which are already known to be very poor provinces. The findings also revealed that malnutrition was related to socio economic status.

However there were no inequalities in nutritional status among children from the white households. Their findings supported the assumption that inequalities in socio economic status of households does affect the nutritional status of U5 children negatively or positively.

Statement of the Problem

Maternal and child undernutrition is directly attributable to 35% of all global child deaths [4]. In Harare the Health Department's mortality patterns indicate that over 40% of children under 5 years who die have malnutrition as an underlying cause. Thus malnutrition is the 4th cause of death among the < 24 months age group and 3rd leading cause of death among the <5 age group. The deterioration in nutritional status of the children under-five years is a public health concern. Stunting increased over the years from 2007 to 2011 in Harare [6-8] with a year on year increment in its prevalence Harare City Health Department annual reports, 2007 – 2011 [10].

Justification

Stunting is preventable and measures can be put into place to prevent its occurrence. The study was conducted so that modifiable factors associated with the development of stunting can be identified and targeted for preventive programming. Factors associated with and the possible causes of stunting among the < 59 months age group had not yet been explored in Harare's suburbs. Evidence generated from the study is required to inform policy, practice as well as to generate interest in further studies.

Research Questions

1. What is the prevalence of stunting among < 59 months age group in Harare city?
2. What are the principal causes of stunting in Harare city among < 59 months age group?

Objectives

To identify and determine factors associated with stunting among children age 0–59 months in Harare.

Specific Objectives

To determine the prevalence of stunting among children aged < 59 months age group.

To assess the socio-economic factors associated with stunting in < 59 months age group.

To determine health service related factors associated with stunting.

To determine patient related factors associated with stunting.

To make appropriate recommendations for interventions.

Data Capturing and Analysis

Epi Info version 3.5.3 was used to enter, clean and analyze the data. Frequencies and proportions were generated for independent variables. In the Univariate analysis, chi-square test/ univariate logistic regression analysis was performed to determine associations between independent variables and outcome of interest stunting. Stratified analysis was done to control for confounding factors and to identify effect modifying variables. Multivariate logistic regression analysis was performed to identify independent risk factors associated with stunting. The logistic regression model

included all variables with a p-value of 0.25 or less. Logistic regression results were presented using odd ratios (OR) and their 95% confidence interval (CI).

METHODS

An analytical cross sectional study was conducted in 4 districts in Harare City on children aged 0 – 59 months and their caregivers. A Harare resident with a child aged 0 – 59 months and caregiver aged 18 years or above were included in the study. A minimum sample size of 337 respondents was determined. Multistage sampling technique was used. The first stage involved the random selection of four 4 districts out of 8 administrative districts using the table of random numbers. The second stage involved randomly selecting 2 suburbs from each selected district. At the third stage, households were randomly selected using the table of random numbers from the list of households available. At household level a mother- and- child pair was identified and studied.

Ethical Procedures

The proposal was approved by the College of Health Sciences Joint Institutional Review Board (JREC) and the Medical Research Council of Zimbabwe. During data collection Guardians were provided with explanation about the objectives of the study and were given time to ask questions in any aspects of the study that they did not understand All respondents signed a consent before the data collection process was carried out.

Data Collection

Data was collected using a structured interviewer administered questionnaire to a mother/caregiver – child pair to establish the determinants and risk factors of stunting among the 0 – 59 months old children. This questionnaire contained sections to assess information on demographic, socioeconomic, anthropometric, health related and dietary factors.

RESULTS

A total of 342 children aged 6 – 59 months were sampled into the study, their median age was 16 months (with interquartile range (IQR); $Q_1=11$, $Q_3=26$) and 178 (52%) were males. A total of 342 questionnaires were administered to the mother/caregiver - child pairs and corresponding anthropometry was measured. Most (96%) of the children in the sample were born in health care institutions.

Table 1: Prevalence of Stunting in Harare, 2013 (n = 342)

Variable	Frequency	%
Stunting status		
Moderate stunting	66	19.3
Severe stunting	34	9.9
Not stunted	242	70.8

Overall stunting in children 6 – 59 months was 29.2%, with moderate stunting at 19.3% and severe stunting at 9.9% (Table 1). Compared to males, more females were stunted (32.9% vs. 25.9%), while more males were wasted than females (Table 2).

Most of the mothers/caregivers had attained secondary education 271 (79.2%) whereas 55 (16%) had completed primary schooling. Most respondents were unemployed 242 (71%) and these women further rely on their husbands as the main sources of family income 334 (97.7%).

The median weight of non-pregnant/breastfeeding mothers were 62 kgs (with IQR; $Q_1=54.9$; $Q_3=70.2$ kgs) with a corresponding median body mass index of 23.36 kg/m^2 ($Q_1 = 21.47$, $Q_3 = 27.16$) their median height was 1.61 m (with IQR; $Q_1=1.58$, $Q_3=1.65$ m). The gestation period for 322 (94.2%) of the children were full term. Most mothers (82.2%) cited growth monitoring as the main reason for their previous health centre visits. Almost half the children 156 (45.6%) had suffered some form of illness in the 2 weeks preceding the day

Table 2: Prevalence of Stunting by Gender in Harare, 2013 (n = 342)

Variable	Male		Female	
	Frequency	(%)	Frequency	(%)
Stunting status				
Moderate stunting	32	(18.0)	34	(20.7)
Severe stunting	14	(7.9)	20	(12.2)
Not stunted	132	(74.2)	110	(67.1)

of the interview. The report of a child having ever been breastfed was universal with 335 (98%) having been given mother's milk.

Table 3a: Distribution of Background Information of Children between 0 – 59 Months (n = 342)

Variable	Frequency	%
Gestation period		
Full term	322	94.2
Pre-term	20	5.8
Main reason for clinic visit		
Growth monitoring	281	82.2
Immunization	26	7.6
Treatment	35	10.2
Illness in last 2 weeks		
Yes	156	45.6
No	186	54.4
Ever admitted to hospital		
Yes	40	11.7
No	302	88.3
Child ever breastfed		
Yes	335	98
No	7	2
Time first put to breast		
Less than 1 hour	201	60
1 – 24 hours	108	32.2
> 1 day	20	6
Don't know	13	1.8
Child still breastfeeding		
Yes	165	49
No	172	51
Age child stop breastfeeding		
0 – 6	11	6.5
7 – 12	23	13.6
13 – 19	105	61.4
20+	32	18.5
History of < 6 months feeds		
Yes	83	24.5
No	256	75.5

Table 3b: Socio-Demographic Characteristics of children (n = 342)

Variable	Frequency	%
Sex		
Male	178	52
Female	164	48
Place of birth		
Hospital	149	43.6
Clinic	180	52.6
Home	13	3.8

Most of the children (96.2%) were delivered at a health institution, however only 201 (60%) were put to breast within the first hour, furthermore 139 (81.5%) were weaned from breast milk before the internationally agreed 24 months. The children' median weight was 10.3 kgs, median height was 10.kgs and the mid-upper arm circumference was 15.1 centimeters.

Table 4: Household Variety of Food Intake (n = 342)

Variable	Last 24 hours		Last 7 days	
	Frequency	(%)	Frequency	(%)
Carbohydrate				
Cereals	324	(94.7)	340	(99.4)
Tubers	131	(38.3)	260	(76.0)
Vegetables	180	(52.6)	262	(76.6)
Fruits	197	(57.6)	306	(89.5)
Meats	201	(58.8)	289	(84.5)
Eggs	95	(27.8)	250	(73.1)
Fish	38	(11.1)	167	(48.8)
Lentils	98	(28.7)	252	(73.7)
Milk products	289	(84.5)	270	(78.9)
Fats	316	(92.4)	334	(97.7)

Table 7 above shows the history of food intake in the last 24 hours and seven days. Most (73.3%) of the respondents reported a food score of more than 6 out of 10. The median birth weight of children was 3 015 grammes (with IQR; $Q_1 = 2\ 700$, $Q_3 = 3\ 350$) while the median age of introduction of complementary feeds was 6 months (with IQR; $Q_1 = 3$, $Q_3 = 6$). In addition the median number of meals children ate the previous day was 3 (with IQR; $Q_1 = 2$, $Q_3 = 4$). Most of the mothers 284 (83%) were aware of the consultation fees by type of service required.

Household treatment of drinking water was low with a proportion of 133 (38.9%). Most respondents reported sharing one toilet with other households and the median for families sharing a toilet was 2 families (with IQR; $Q_1 = 1$, $Q_3 = 4$). Toilet usage was however high with most mothers 308 (90.1%) indicating they had used toilets to dispose of their children' faeces.

Majority of the mothers 139 (40.6%) highlighted the borehole as their preferred choice of water for drinking. Municipal water was unpopular as indicated by the 123 (36%) who resort to drinking municipal water as boreholes in their neighbourhood are not working. Borehole water was the main alternative source of water for drinking 208 (60.8%), followed by municipal water 69 (20.2%) and protected wells coming third at 54 (15.8%).

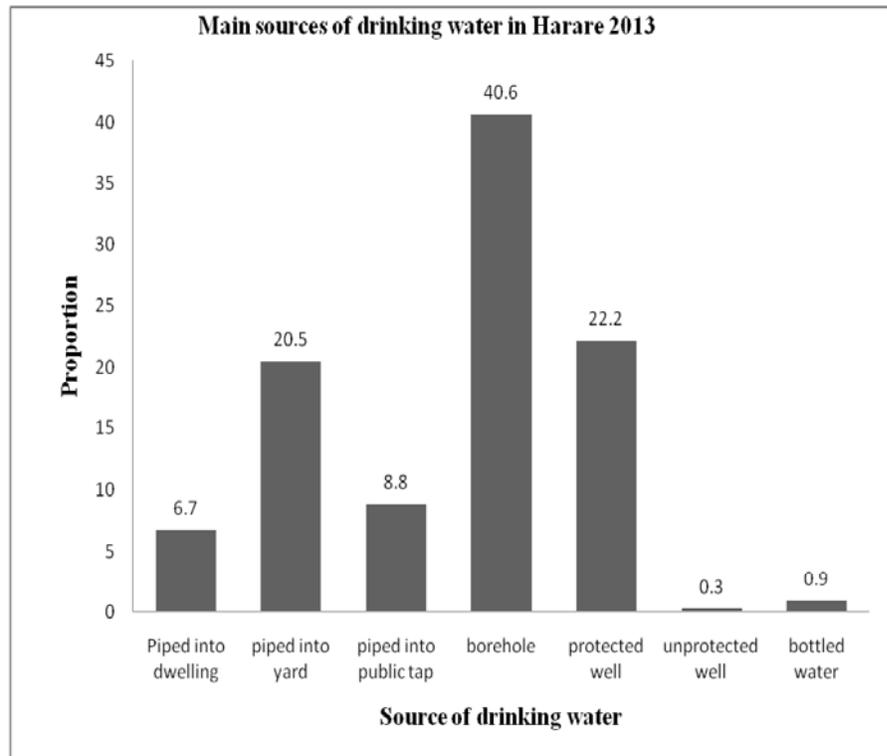


Figure 2: Main sources of drinking water in Harare 2014 (n = 342).

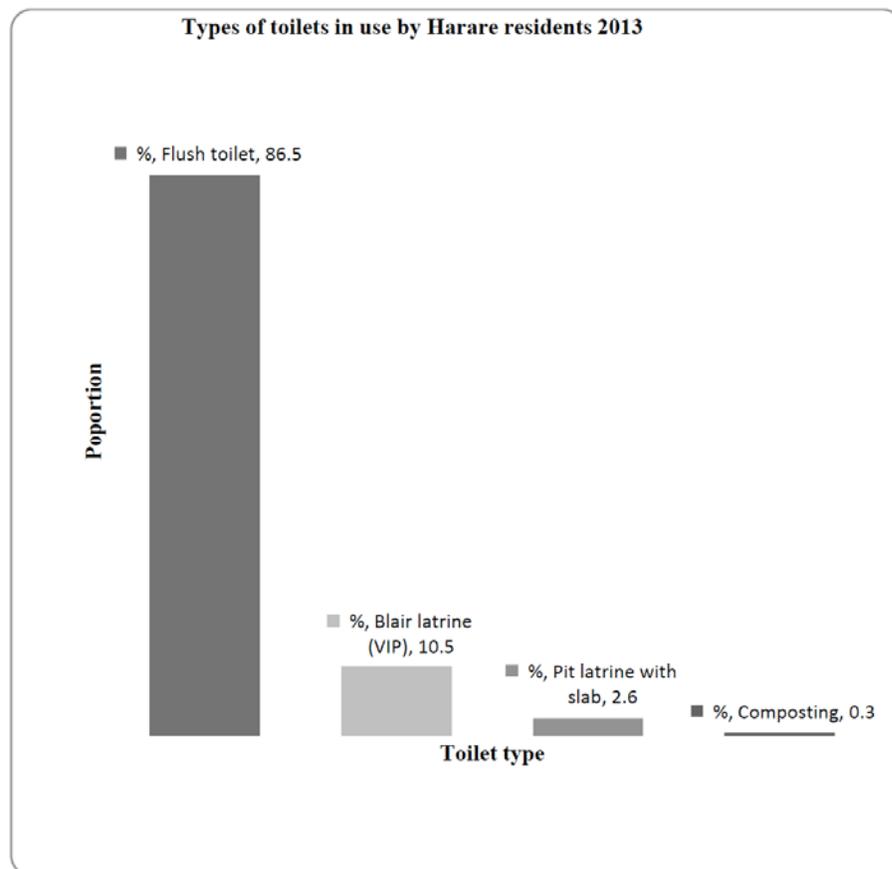


Figure 3: Types of toilets in use by Harare residents in 2013 (n = 342).

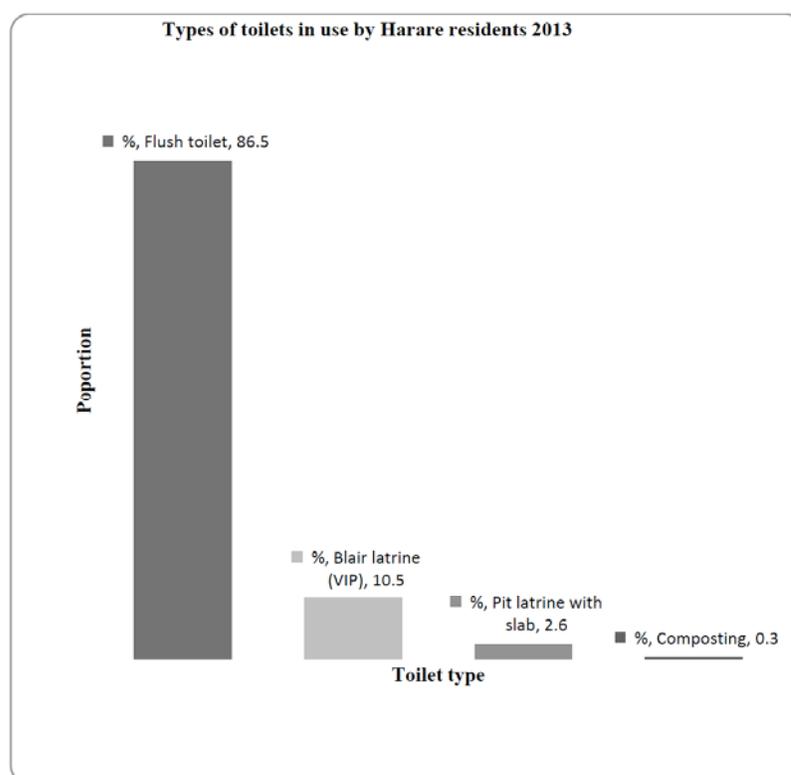


Figure 4: Types of toilets in use by Harare residents in 2013 (n = 342).

Table 5: Socio-Demographic Characteristics Associated with Stunting

Variable	Stunted		pOR	95 % CI	p-value
	Yes	No			
Sex					
Male	46	132	0.71	0.45 – 1.13	0.19
Female	54	110			
Place of birth					
Home	3	10	0.72	0.19 – 2.66	0.85
Institution	97	232			
Education of mother					
Primary	25	37	1.85	1.04 – 3.27	0.04*
Secondary	75	205			
Occupation					
Unemployed	32	67	1.22	1.08 – 2.03	0.02*
Employed	68	174			
Source of income					
Husband	96	238	0.40	0.10 – 1.65	0.36
Self	4	4			
Monthly income					
Above USD\$300	33	108	0.62	0.38 – 1.01	0.07
Below USD\$300	66	134			
Marital status					
Married	96	235	0.72	0.21 – 2.50	0.85
Not Married	4	7			
Area of residence					
High density	97	227	2.14	1.61 – 7.55	0.04*
Low density	3	15			

*Statistically significant.

Table 6: Individual Child Characteristics Associated with Stunting

Variable	Stunted		pOR	95 % CI	p-value
	Yes	No			
Gestation period					
Full term	92	230	0.60	0.24 – 1.52	0.40
Pre-term	8	12			
Illness in last 2 weeks					
Yes	43	113	0.86	0.54 – 1.38	0.61
No	57	129			
Ever admitted to Hospital					
Yes	12	28	1.04	1.01 – 2.14	0.04*
No	88	214			
Ever breast fed					
Yes	98	237	1.03	0.19 – 5.42	0.70
No	2	5			
Time first put to breast					
After first hour	41	93	1.11	1.09 – 1.80	0.03*
Within first hour	57	144			
Age stopped breastfeeding					
More than 24 months	1	3	0.78	0.08 – 7.70	0.73
Less than 24 months	50	117			
Fed food before 6 months					
Yes	28	55	1.30	1.17 – 2.21	0.01*
No	72	184			
Birth weight					
Less than 2 500g	93	218	1.46	1.29 – 3.51	0.02*
More than 2 500g	7	24			

*Statistically significant.

Table 7: Household and Community Characteristics Associated with Stunting

Variable	Stunted		pOR	95 % CI	p-value
	Yes	No			
House hold dietary diversity food score					
< 5	26	59	1.07	1.01 – 1.84	0.01*
6+	68	165			
Drinking water treatment					
Yes	35	98	0.79	0.45 – 1.28	0.41
No	65	144			
Child stool disposal					
Toilet use	6	28	0.49	0.20 – 1.22	0.17
Non toilet use	94	214			

*Statistically significant.

Harare as a metropolitan city has sewer systems with flush toilets 296 (86.5%). However some respondents indicated they have been without water for periods spanning years, hence they constructed Blair toilets or pit latrines that is 36 (10.5%) and 9 (2.6%).

From the univariate analysis factors, Tables 5-7 residing in high density (OR = 2.1495% CI 1.61-7.55),

having an unemployed caregiver (OR = 1.2295% CI 1.08-2.03) and having a mother with primary education (OR = 1.8595% CI 1.04-3.27) were significantly associated with stunting. In particular residing in high density areas increased the risk of child stunting by 21%, while having an unemployed caregiver increased the risk by 12% and having a mother with primary education increased child stunting risk by 19%.

Table 8: Distribution of Characteristics Related to Access to Health Service (n = 342)

Variable	Frequency	%
Consultation fees		
Free	260	76
Less than USD\$5	24	7
USD\$5 – USD\$10	56	16.4
USD\$10 – USD\$20	2	0.6
Distance to nearest health centre		
Less than 10 minutes	64	18.9
10.1 – 20 minutes	100	29.5
20.1 – 30 minutes	105	31.0
> 30.1 minutes	70	20.6

Table 9: Distribution of Community Characteristics (n = 342)

Variable	Frequency	%
Water treatment at household level		
Yes	133	38.9
No	209	61.1
Common water treatment methods		
Boiling	38	27.9
Chlorination using solutions	27	19.9
Use of tablets	69	50.7
Solar disinfection	2	1.4
Child stool disposal at household		
Child used toilet	44	12.9
Parent/guardian put into toilet	264	77.2
Put into drain	7	2
Thrown in garbage	25	7.3
Buried	2	0.6

Ever being admitted to hospital (OR = 1.04, 95% CI 1.01-2.14), being put to breast after 1 hour (OR = 1.11, 95% CI 1.09-1.80), having complementary feeds before 6 months of age (OR = 1.30, CI 95% 1.17-2.21), and a child birth weight of less than 2500 grammes (OR = 1.46, 95% CI 1.29-3.51) were significantly associated with child stunting. In particular ever being admitted to a hospital increased risk of child stunting by 10%, having complementary feeds before 6 months increased child stunting risk by 13%, and low birth weight increased child stunting risk by 15%.

Having a household dietary diversity score of less than 5 out of 10 was a statistically significant risk factor to child stunting. Drinking treated water at household level was protective of stunting but this was not statistically significant.

Stratified analysis was carried out for a number of child variables and maternal elements to check for effect modification and control for possible confounding. After controlling for confounding, only mother's education remained statistically significant. Having a caregiver who completed secondary education reduced the child risk of stunting by 49% (Adjusted POR 0.49 95% CI (0.26 – 0.94)).

DISCUSSION

The study aimed to establish the prevalence and risk factors for stunting in Harare city. The study found out that (29.2%) of children aged 0 – 59 months were stunted. Compared to the year 2012, this demonstrated a 1% increase in the prevalence of stunting. Our findings of 29% prevalence are consistent with the classification of Zimbabwe as a medium to high

Table 10: Distribution of Socio-Demographic Characteristics of Mothers/Caregivers (n = 342)

Variable	Frequency	%
Education		
None	7.0	2.0
Primary	55	16
Secondary	271	79.2
Tertiary	9.0	2.6
Occupation		
Formal employment	21	6.2
Informal employment	78	22.9
Unemployed	242	71.0
Source of income		
Husband	334	97.7
Self	8	2.3
HIV status		
Positive	34	9.9
Negative	289	84.5
Unknown	19	5.6
Household income		
< USD\$100	39	11.4
USD\$101 – USD\$300	161	47.2
USD\$301 – USD\$600	105	30.8
> USD\$601	36	10.6
Residence		
High	307	89.8
Medium	10	2.9
Low	8	2.3
Peri-urban	11	3.2
Rural	6	1.8
Marital status		
Married monogamous	309	90.4
Married polygamous	6	1.8
Single never married	4	1.2
Cohabiting	16	4.7
Divorced/separated	6	1.8
Widowed	1	0.3
Age at first child		
15 – 19	118	34.5
20 – 24	175	51.2
25 – 29	41	12.0
30 – 34	6	1.8
35 – 39	1	0.3
40+	1	0.3
Age at current child		
18 – 20	47	13.7
20 – 24	118	34.5
25 – 29	83	24.3
30 – 34	67	19.6
35 – 39	15	4.4
40 – 44	11	3.2
45+	1	0.3

stunting country according to the WHO [5]. Furthermore prevalence established is almost similar to

the ZDHS [8] 2010/11 stunting prevalence for Harare which stands at 28.3%.

The main statistically significant risk factors for stunting found from the study were: the mother having had only primary education, being unemployed, a child being admitted to a hospital, a child who was put to breast after 1 hour of birth, a birth weight of 2 500 grammes and less and a household dietary diversity score of less than 5 out of a possible 10. Significant protective factors to stunting identified from the study were: being married, having the husband as the main source of income, a household monthly income of more than USD\$300 and drinking treated water/clean water at household level.

The insignificant protective factors were: gender being male, home deliveries, having a full gestational term for the child and stopping breast feeding after 24 months of age. It must however be noted that all study children had up to date vaccination statuses hence vaccination was not analyzed in this current study.

In the current study, being from the less privileged groups was a risk factor initially but disappeared in subsequent multivariate analysis. The effects of income are known to be mediated through other underlying determinants. These findings are consistent with findings of a study on stunting in Libya by Taguri, A.E. *et al.* [15]. These factors determine the ability of the family to combine their knowledge, resources and patterns of behaviour, to promote, recover or maintain health status and to cope with a difficult environment. Such factors include parental education, psychosocial stimulation and household environment. People living in urban areas are supposed to be provided with better access to health services, education and other social support systems which are no longer readily available or easily accessible to residents in Harare in the last decade due to economic decline and over population.

Lack of education was shown to be a significant risk factor to stunting. This is consistent with a study conducted in Ethiopia by Christiansen [16] which concluded that a child with a caregiver with less than 12 years of schooling was at highest risk of stunting POR 3.2 at 95% CI (2.9 – 3.89). In agreement with most studies low maternal education was a major determinant of stunting in the study. These findings are further supported by Mandrefo *et al.* [11] who identified that undernutrition was significantly associated with poor education of the father and having more than four children born to the mother.

Expectedly, as the duration of mother's education increases, her finances and consequent contribution to

the family income also increase. This places the family at a higher social class and, therefore, better nutritional status. In addition, educated mothers are more likely to make decisions that improve child nutrition and health. An educated woman is more likely to send all her children to school, thereby breaking the chain of ignorance; making better use of the childhood survival strategies, such as sufficient breastfeeding, immunization, household oral rehydration therapy, and family planning.

The occupational status of the mother, specifically being unemployed was a significant risk factor for child stunting. This can be linked to lack of education which results in women having a low socioeconomic status. This affirms B. Teshome *et al.* [13] findings in their study on magnitude of stunting in children less than five years of age in food surplus region of Ethiopia. They found that unemployed women were almost two times likely to have a stunted child than their economically privileged counterparts OR 1.98 (95% CI 1.21 – 2.86) [13].

Area of residence was shown to have an influence on stunting. Residing in high density was shown to be a risk factor for stunting in the study. This affirms what R.A. Ricci, *et al.* [17] concluded whereby place of residence can be used as a proxy for economic status. In a similar study the finding Kandala *et al.* [12] in the democratic Republic of Congo confirmed that living in a rural area within certain environmental cultural settings impacted upon nutritional status where those in rural poor areas were stunted compared to the urban group.

According to the study high density residence entailed overcrowding, inadequate water and sanitation facilities. This sustained exposure of children to adverse environments (poor water and sanitation) retards child linear growth. Findings from a study by Zere and McIntyre [14].

To identify the burden of socio economic inequalities on U5 nutritional status support the above findings since stunting was found to be related to poor socio economic status of households in the Eastern Cape and Northern Provinces which are known to have a poor socio economic status.

According to this current study being male was shown to be an insignificant protective factor to stunting. This is plausible as it is consistent with Teshome *et al.* [13] studies in Ethiopia which showed that female children are at a higher risk of stunting than male children.

Place of birth, specifically home delivery was shown to be a protective factor to stunting. This statistically insignificant factor is not credible as it disagrees with findings on studies conducted on chronic malnutrition. To authenticate this, A. Rayan *et al.* [18] in his study in Bangladesh proved that children delivered at home under traditional delivery systems without medical care had a higher risk of stunting. This was largely attributed to the fact that in medical set ups health education on complications; maternal and child nutrition and best feeding practices is given which may have positive outcomes on maternal and child health.

The father as the main source of income was shown to be a protective factor. Though insignificant, this is in harmony with findings by Christiansen [16] where father's education emerged as an important factor associated with stunting. Their analysis concluded that children whose fathers are educated were less likely to be stunted compared to children with uneducated fathers. This was because fathers are the main income earners and decision-makers, thus their education plays an important role in ensuring they provide better nutrition for their families. Fathers may have an advantage in accessing a better job and thus increasing family income. Adored and Abiola [19] Assessed factors related to nutritional status of children under five. The prevalence of stunting was found to be 12.5%. Factors such as household size, low educational status of the mother negatively correlated with nutritional status of the child. Higher educational status of the mother, hygienic practices in food preparation were positively correlated with the nutritional status of the child.

Marital status was shown to be protective from stunting. This insignificant characteristic is paradoxical solely due to the factors that studied marriage in relation to stunting focused on monogamous and polygamous marital unions. According to Senbanjo *et al.* [20], polygamy was shown to be a risk factor for stunting in such studies as there may be competition for nutritional resources within this largely predominant African custom.

Though insignificant, monthly income of more USD\$300.00 was shown to be protective to stunting in the study. This is consistent with findings from a study by Orach [21] in Ghana on the effect of economic inequality on chronic childhood undernutrition in Ghana. He found that children from the poorest quintile of households are more than twice as likely to suffer from stunting compared to children from the richest quintile.

Amongst the child characteristics associated with stunting, time first put to breast was found to a statistically significant factor. In essence being put to breast after 1 hour is a risk factor. This concurs with studies in Ethiopia by B. Teshome [13] which indicated that babies who did not receive colostrum were at a higher risk for stunting. This was attributed to assertions that infants who do not receive colostrum may have high incidence, duration and severity of illnesses such as diarrhoea.

Giving children complementary feeds before they reach six months of age was also a significant risk factor in the study. This is in agreement with other studies where prominence of other food materials before 3 months was among feeding practices explaining risk of stunting. Ayaya [22] in Ethiopia showed that children who received complements before 6 months were found to be at a significantly higher risk of stunting than those who did not.

Low birth weight was established to be a significant risk factor for stunting. This affirms the finding by [23] where the prevalence of stunting, especially among children less than 2 years of age, reflected the prevalence of low birth weight in a population. This influence of birthweight on child linear growth confirms other findings that showed links between birth weight and growth through infancy and beyond.

Amongst the plausible yet insignificant child characteristics analyzed was history of illness in the last 2 weeks for the child. Not being ill is protective of stunting according to this study. This is in tandem with findings of other studies where incidence of diarrhoea is negatively associated with stunting. Guerrand *et al.* [24] reviewed the evidence relating to the association between stunting and episodes of diarrhoea. They noted that a large proportion of populations in the world live in absolute poverty. This situation is further exacerbated by lack of access to clean water and safe sanitation. These communities experience high episodes of diarrhoea among the under five children. Diarrhoea in turn contributes to an impoverished gut which reduces the absorption of nutrients which in turn results in malnutrition and stunting of the child under five. The cycle of diarrhoea malnutrition perpetually contributes to chronic malnutrition thus demonstrating the reciprocity of disease and the environment in form of social determinants of health.

According to this study age at which a child is stopped breastfeeding if more than 24 months was

shown to be protective to stunting. This however is divergent with B. Teshome *et al.* [13] findings where their study revealed that prolonged breastfeeding is indeed a risk factor for stunting. It was paradoxical children breastfed for more than 2 years were at increased risk of stunting than those who did not receive breast milk beyond 2 years.

In as far as household and community characteristics, household dietary diversity that is a total food score of less than 5 out of a possible 10 was revealed to be a risk factor. This concurs with other studies in the developing regions where diets are mainly cereal based. Thus complements given to children are plant sources and conversely feeding with animal sources is low, so is the vegetable and fruit consumption thus consequently children fail to access enriched complementary diets.

Notable plausible insignificant household and community factors were drinking treated water at household level and use of proper sanitary facilities. These factors were shown to be protective from stunting. This is in accordance with findings by Judith A. Ricci [17] in Philippines who found out that continued exposure to adverse environmental conditions over an extended period of time retards child linear growth.

CONCLUSIONS

The study aimed to establish the prevalence of stunting and the factors associated with stunting. In addition also aimed at establishing the specific determinants of stunting at household and community level so as to provide recommendations for interventions in the City of Harare.

The findings have provided a very worrying trend in terms of the prevalence of stunting among the 0-59 month age group which is clearly on the increase as shown by various studies. This is reflected by the fact that the findings indicate that (29.2%) of children aged 0 – 59 months were stunted. This shows an increase of 1 % since 2012. The status of stunting is not getting any better since Zimbabwe is already classified by WHO as being in the medium range 30-39.9% which in global stunting. The ZDHS [6] carried out every five years also confirms prevalence of stunting to be at 29% for children U5 years (0-59) months in Harare. The findings show that malnutrition is getting worse. The findings however show that the factors that are associated with stunting can be addressed through improving the environment by addressing social

determinants of health such as poor access to clean water and access to employment. It is also worrying that the risk factors in the overall framework of social determinants of health are currently being exacerbated by the poor economic situation which has devastated Zimbabwe in the past decade. The study was carried out in the high density suburbs where inequalities in social determinants of health such as: housing, access to water, education and employment are normally found. It is our hope that the inclusion of the Nutrition cluster in the current Zimbabwe Economic blue print ZIMASSET [25] will facilitate the improvement of household and country food security through improved agricultural methods and economic reform and general improvement in institutional and economic governance at all levels.

COMPETING INTERESTS

The authors declare no competing interest.

AUTHORS CONTRIBUTION

All authors contributed equally to the process.

LIST OF ABBREVIATIONS

BMI	=	Body Mass Index
CI	=	Confidence Interval
DCM	=	Department of Community Medicine
JREC	=	Joint Parirenyatwa Hospital and College of Health Sciences Research Committee.
HCH	=	Harare City Health
MUAC	=	Mid Upper- Arm Circumference
MRCZ	=	Medical Research Council of Zimbabwe
MOHCW	=	Ministry of Health and Child Care
OR	=	Odds Ratio
UNICEF	=	United Nations Children's Fund
WA	=	Weight for Age
WH	=	Weight for Height
WHO	=	World Health Organization
ZDH	=	Zimbabwe Demographic Health Survey

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