Water, hygiene and sanitation practices are associated with stunting among children of aged 24-59 months in Lemo district, South Ethiopia, in 2021

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Research Article

Keywords: Water, Sanitation, Hygiene, Stunting, children

Posted Date: April 5th, 2022

DOI: https://doi.org/10.21203/rs.3.rs-1449615/v1

Additional Declarations: No competing interests reported.

Version of Record: A version of this preprint was published at BMC Nutrition on January 23rd, 2023. See the published version at https://doi.org/10.1186/s40795-023-00677-1.

Abstract

Background

Stunting among children from 24 months to 59 months is a major public health challenge in developing countries like Ethiopia. It has been linked with poor water quality, lack of environmental sanitation, and personal hygiene (WASH) practices. However, complete understandings of risk factors (WASH) which contribute for stunting were not explored at the study area.

Objective

This stud aimed to assess the prevalence and factor associated with stunting among children aged 24–59 months in Lemo district, South Ethiopia, in 2021.

Methods

A community based cross-sectional study was conducted from January 1–30/2011. Data were collected from 415 randomly selected child and mother /caregiver pairs/. A structured and interviewer-administered questionnaire and direct observations of anthropometric status generated WHO Anthropometric were used as means of data collection. Logistic regression analysis was conducted. Variables with p-value < 0.25 in the binary logistic regression model were fitted into multivariable logistic regression analysis to identify factors associated with stunting. Variables with AOR and 95% CI and P-value < 0.05 was computed and reported as final risk factors of stunting in the study setting.

Results

From the total of 422 children, only 415 children were included in the final analysis of this study making a response rate of 98.3%. The prevalence of stunting in the study area is 33.5% (95%CI, 30.4% -36.6%) in this study. Children whose age was from 48–59 months (AOR = 2.8, 95%CI, 2.1, 12.1), children whose age 36–47 months age (AOR = 1.6, 95%CI, 1.1, 7.1), children of uneducated women (AOR = 1.8, 95%CI, 1.5, 4.2), children who live in unimproved toilets (AOR = 1.7, 95%CI, 1.2,2.6), children whose feces was disposed unsafely (AOR = 2.8, 95%CI, 1.57, 5.31), children whose mothers did not wash their during feeding their children (AOR = 6.2, 95%CI, 6.2 (2.0, 19.1) were factors associated with stunting among children of 24 month to 59 months.

Conclusion

Stunting is still high in the study area. Policy makers, program managers and community health works should enhance environmental sanitation, awareness creation about personal hygiene and improved

toilet construction and utilization. Furthermore, the local government should work to improve socio-economic status of poor household through inter sectorial collaboration.

Background

Nutritional status of children is important as it determines their health, physical growth, development, academic performance and progress in life. Under-nutrition remains a problem in under five age children in developing countries, and it is responsible for more than one-third of under-five children deaths globally. Globally, one every five under five children were stunted. Also one of 13 under-5 five children was wasted. Whereas one every seven under five children remained underweight of which SSA and South Asia accounted for nearly 90% of all cases [1].

Childhood malnutrition can affect potential for growth and the risk of morbidity in later years of life. It was associated with stunted growth, lower body weights, and shorter heights Despite the fact that the rate of stunting had declined in some regions, including Asian, by one third from 1990 to 2015, this has not been the case for Sub-Saharan Africa [2]. A large proportion of children in developing countries are impacted by anemia, vitamin A deficiency [2, 3] and parasitic infections [4] which negatively impact their nutritional status, cognitive development, and school performance [5]. Ethiopia has demonstrated promising progress in reducing levels of under-nutrition over the past decade. But, Prevalence of stunting has decreased over the past decade but remain high [4]. Water, sanitation and hygiene (WASH) practices are fundamental human right and contributes significantly to the nutritional status of under-five children [6]. Water for domestic purpose is shortage among rural communities and majorities rely on surface water which is unsafe for human consumption[3]. In addition, this water sources is shared between human and both domestic and wild animals. Water treatment methods such as boiling are yet to be implemented because of financial and cultural barriers. Furthermore, open defecation is still practiced in most communities and the few with sanitation facilities own pit latrines without slab [3] which can pose a risk of fecal contamination [7]. For the case of Ethiopia, 35.2% of its people rely on unsafe water for their domestic purpose, 35.4% have access to Piped/tap water, 52.2% use pit latrine without a slab or open pit, and 32% of households have no toilet facility at all. The current demographic and health survey of Ethiopian reported that 38% under 5 year children were stunting [3] About 53% of all child mortality associated with under-nutrition, which is mainly due to infection and malnutrition[7]. A number of environmental, social, demographic, cultural, and economic factors contribute to poor nutritional status among children under-five years[8, 9]. The indirect causes of under-nutrition, including food insecurity, inadequate childcare practices, low maternal education, and lack access to health services, lack of access to clean water and sanitation, and poor hygiene(WASH) practices(6,8,9) Children whose health status is compromised by different infectious diseases are at greater risk of malnutrition similarly, children's who are malnourished will have a reduced resistance of infection. Pre-school children constitute malnutrition vulnerable segment of any community. The nutritional status is sensitive indicators of community's health and nutrition. Several studies have reported a strong correlation between WASH practices and nutritional status among under-five children. Previous evidence shows that 64.1% of the households in Lemo district had poor sanitation facilities [10]. Previous study findings are inconsistent

with the impact of food insecurity on wasting [11–13]. Based on the report of previous stud, only 36% of the population of the area is approved to be food secured. On the contrary 18%, 13% and 33% of the population are mild, moderately and severely food in secured respectively [14]. Strengthening public health interventions for under nutrition among children of age 24 months – 59 months effective implementation and evaluation of the strategies at district level is mandatory. WASH practices in communities of Lemo district is poor so that the extent of such practices might be associated with stunting among vulnerable children in this food insecure study setting.

Therefore, this study aimed to assess prevalence and factors associated with stunting among children aged 24–59 months in Lemo Districts, South Ethiopia, in 2022.

Methods

Description of the study setting, design and period.

This study was conducted in Lemo district of Hadiya zone. Hadiya zone is one of the major zones found in Southern Nation Nationalities and Peoples Regional States (SNNPR) of Ethiopia. Hadiya Zone is most intensively cultivated and densely populated areas of Ethiopia. Enset based mixed crop-livestock production is the main agricultural production system. Lemo district is located at a distance of 230 km in North East from Addis Ababa, the capital city of Ethiopia and 187 km from Hawassa, the capital city of SNNPR region.

According to CSA 2017/2018 report, major population (97.3%) of Lemo district was rural residents. There are a total of 35 Kebeles most of which (33) are rural and 2 Kebeles are urban. There are 7 health centers and 35 health posts in the districts. There were 65 health extension workers which work in health posts. Farming comprises the major (65.5%) populations' livelihood. This is a community based cross sectional study was conducted in Lemo district of Hadiya Zone from March to April 2021.

Source population

Children of age category of 24 to 59 months in Lemo district were the target population in this study. Furthermore**, c**hildren whose age group were from 24-59 months and randomly selected and presented during data collection period were the study population in this study. Mothers /Caregivers/ pairs whose children were in the age group from 24-59 months agreed to participate in the study were included in this study. Mothers who were unable to give full response and critically ill during data collection period were excluded from the study.

Sampling and sample size determination

The sample size for this study was determined using single population proportion formula with the following assumptions: Prevalence of stunting (52.1%) in of Saesie Tsaeda-Emba District, Tigray, North Ethiopia [15], 95% confidence level, 5% margin of error. Hence, the sample size was computed using

standard Cochran formula, $n = z^2pq/d^2$. Then, plugging values in the formula, a total sample of 384 were found. By considering a non-response rate of 10%, the final sample size was calculated to result 422.

Based on the report of figure 1, this study was done throughout the rural Kebeles in Lemo district.

Based on the report of figure 1, multistage sampling (two stages) was applied to Kebeles (Sub-districts). In the first stage, one urban Kebele and 10 rural Kebeles were selected with lottery method. In the second stage, households were selected using systematic random sampling technique. A sampling frame of registered children was identified from health posts and family folder. It consists of lists of 24-59 months children in the Kebele health post. Each household for this study was identified using systematic random sampling. The first household was identified using lottery methods and then subsequent households were selected using Systematic random sampling every sample at K^{th} (N/n). The households selected for this study which contain children's of age 24-59 months were proportionally allocated in each Kebele. A representative sample of 422 households was selected (**See figure 1**).

Measurement

According to the report of figure 2, the dependent variable of this study is the status of stunting among children. Stunting is determined by measuring the height and age of the child and compares the height for age score of children with the WHO standardized score. The independent includes the socio-demographic characteristics, children characteristics, parent characteristics and Environmental risk factors. Figure 1 of this study indicates the influence of socio-economic status of the family, parent characteristics and environment variables on childhood stunting status. The child height was measured using measuring board. The vertical and horizontal measuring board reading reaches a maximum of 175cm and capable of measuring to 0.1cm. The child was measured accurately as much as possible with bare foot, standing in perfect erection position to touch the measuring board by most part of the body. Two readings were recorded and the computed average was used in the analysis. Length was measured as by making the child lie flat on the length board. The sliding piece is placed at the edge of the bare feet as the head touches the other end of the measuring device. Then two readings were taken and the average was computed. Weight was measured by using an easily portable weighing scale, graduated by 0.1 kg, was used. The scale was adjusted before weighing every child by setting it to zero. Two readings were taken for each child and the average was recorded on the questionnaire (**See figure 2**).

Operational definitions

Food insecurity: Is a state or a condition in which people experienced limited or uncertain physical and economic access to safe, sufficient and nutritious food to meet their dietary needs or food preferences [16].

Food security: A situation when all people at all times have both physical and economic access to safe, sufficient and nutritious food to meet their dietary needs or food preferences for a productive, healthy and active life [16, 17].

Stunting /chronic malnutrition/: Reflects long term cumulative effects of inadequate nutrition and health. Shortness in height refers to low height-for-age that may reflect either normal variation in growth or a deficit in growth. It is defined as low height-for-age at< -2 SD of the median value of the NCHS/WHO international growth reference [18].

Data collection tools and procedure

A structured and interviewer-administered questionnaire was used to collect socio-demographic variables of mothers and child characteristics. Furthermore, anthropometric measurements were taken to determine the nutritional measurement outcome: Weight, Height and Childs age was taken to investigate the nutritional status of the children. The questionnaire was first prepared by English then translated to Hadyiyissa and back to English to keep its consistency. Interview was conducted in the local language (Hadyiyissa) for easy understanding. Also, anthropometric measurements such as Weight, Height and Childs age was taken to assess the nutritional status of the children. Children were examined to find signs of malnutrition (stunted, wasted or underweight) with the help of seven BSC nurses which had previous experience in measuring child malnutrition outside of the study area. The Growth standard anthropometric measurement procedure was performed according to World Health Organization recommendation[19]. The children's age was determined with interrogation and confirm through probing. The age of the children was collected from the health posts family folder as well as mother or caregiver of the children. Weight was recorded in kilograms by using standard calibrate machine. During measuring weight each subject was asked to bare footed and to remove heavy cloths. Weight was measured to the nearest 0.1kg. Weighing scale was calibrated to zero before taking every measurement; Measuring of height, subjects was positioned to stand on the platform, bare footed with their head upright, looking straight forward by using standard height measuring scale. Height was measured to the nearest 0.1 cm.

Data quality control

A pretest was performed on 5% of households that were not included in the actual samples of the study. Data collectors and supervisors were trained for three days to improve the quality of data. Training was given about the aim of the study, sampling procedure and data collection technique. Questionnaire was pretested on 5% of households that were not included in the actual samples of the study. At the end of each day, the completeness of the questionnaires was checked by the principal investigator.

Data analysis

Data were cleaned, coded and entered using Epi-info7 software. Then, it was exported to Statistical Package for Social Sciences (SPSS) software version 24 for analysis. WHO anthro program version 3.2.2 software was used to generate nutrition indexes and export to SPSS. Before the actual logistic regression analysis, necessary assumption of logistic regression analysis was checked. The World Health Organization (WHO) growth reference was used to report anthropometric result; Individual anthropometric

data was compared with reference values on a graph using sex and age specific the z-score classification system.

The nutritional status indicators, weight-for-Height (WHZ), Height-for-age (HAZ) and weight-for-age (WAZ) were compared with the reference data from World Health Organization standards. Children below-2 standard deviations (-2SD) of the WHO median for WHZ, HAZ, and WAZ were considered as wasted, stunted or underweight respectively. A cut-off of below-2 standard deviations (-2SD) of the WHO median for HAZ was considered. Frequencies and cross tabulations were used to check for missed values and variables. Descriptive analysis was made using percentage, mean, standard deviations for variables included in the study. Variables with a P-value < 0.25 were taken as a candidate variable for the multivariable logistic analysis. Multivariate logistic-regressions were used to adjust for possible confounding variables. Adjusted odds ratio with 95% CI and P-value < 0.05 was computed to assess the strength and significant level of the association. Finally, Hosmer-Lemeshow goodness of test was used to check the model fitness.

Result

Socio-demographic characteristics of the study subjects

According to the report of table 1, from the total of 422 households visited, complete responses were obtained from 415 which make the response rate to be 98.4%. From 415 mothers/caregivers (aged 18-43 years, mean (± SD) age 32.72 (± 4.67)) were interviewed with a response rate of 100%. The majority of the study participants were Housewives, 333 (80.2%) have job, protestants, 376 (90.6%) in religion and can't read and write, 162 (39%) and Hadiya in ethnicity, 386 (93%). Nearly two thirds (69.4%) of households had five or more household members with mean (± SD) family size of 5.3 (± 1.8). The majority of households 206 (48.6%) were Farmers in their work. 218 (52.5%) of the households in the study area had a monthly income of less than 1000 ETB (**See table 1**).

Sex and age difference of stunting among children in the study setting

Figure 3 reports that WHO reference standard was taking–2SD as cutoff point, the study children who fell below –2SD were calculated as 139(33.5%). The study finding showed that prevalence of stunting (height for age below -2 of the median WHO reference values were higher in female children (53.2%) than males. The highest prevalence of stunting was found among children of age 36-47 months 62% (**See figure 3**).

Water, sanitation and hygiene practices in the study setting

Based on the report of table 2, from a total of 415 study respondents' households using observation check lists were, 299(72%) used unimproved toilet (pit latrine without slab) facilities. From student respondents, 91 (21.9%) had no toilet facilities, 159 (38.3%) were owned nonfunctional the toilet facilities and 341(77.2 %) of the households have no hand washing facilities near the toilets during the survey.

From study respondents, 246(59.3) did not dispose child's feces in latrine. According to table 3, on the other hand from 415 households interviewed about drinking water were, 146(35.2%) used Unimproved water (did not get improve water below 30 minutes for round trip), 287(69.2) got less than 20 liters per day per person and239 (57.6%) of them were found above 1Km from water sources. Household mothers/caregivers were hand washing at critical time: like after defecation, after cleaning babies' anus, before eating or feeding children. Based on this, 301(72.5%), 174(41.9%) and 248(40.2%) did not washing their hand after defecation, after cleaning babies' anus, before eating or feeding respectively (**See table 2**).

Factors associated with stunting in the study area

Based on the report of table 3, seven variables were associated with stunting in the study area. However, only six variables showed statistically significant association with stunting among children of age 24-59 months. Except household who gets less than 20 L water, other factors which were statistically significant on binary logistic regression analysis also show significant association in multivariable logistic regression analysis model. These include: children whose mothers disposed their children feces open field, children live in household of unimproved latrine, children in family who used unimproved water sources and children of women who did not washing hands with water and soap , and children of uneducated women. Children of age group of 36-47 months were 2.8 times more likely to be stunted compared to children of age 24-36 months (AOR=2.8, 95%CI, 1.1, 7.1). The odds of stunting of children of age of 48-59 months was 2.8 times more than the odds of children of age 24-36 months (AOR=2.8, 95%CI, 2.1, 12.1). Compared with children of uneducated women, stunting is 1.8 times more common among children of educated women (AOR=1.8, 95%CI, 1.14, 2.76). Children who lived in household of unimproved toilets were 3.6 times likely to be affected by stunting than their counterparts (AOR=3.6, 95%CI, 1.43, 9.03).The chance of stunting among children of women who had not disposal their child feces unsafely were 2.8 times more likely than their counter parts (AOR=2.8, 95%CI, 1.57, 5.31). The odd of stunting among children whose mothers did not washing their hand with water and soap before eating/feeding/ were 1.7 times more than their counterparts (AOR=1.7, 95%CI, 1.1, 2.6). Children whose mothers did not wash their hands during feeding their children were factors positively associated with stunting in the study area (AOR=6.2, 95%CI, 6.2 (2.0, 19.1) (**See table 3**).

Discussion

This study revealed that prevalence of stunting or chronic malnutrition among children of age 6 to 59 months is 33.5% (95%CI = 31.2%, 35.8%) in this study area. This finding is lower than the national prevalence of stunting in similar study population group in Ethiopia which account as 38% [20]. The possible difference might be associated with the fact that the national finding might be more reliable due to large sample size. This finding is lower than finding of studies done in Ethiopia: Albuko, Northeast Ethiopia (39.3%)[21], Gurage zone, South Ethiopia (52.5%) [22], Gojam, Northwest Ethiopia (37.5%) [12] and Bangladesh (41%) [23]. The difference might be resulted from variation in study setting, level of awareness of the care giver and accessibility of health service. On the contrary, this finding is more than

findings of other studies done in Sodo zuria district, South Ethiopia (24.9%) [24], South East Kenya (23.3%)[25], West Guji, South Ethiopia (31.8%) [26].

The possible explanation for this variation might be associated with the fact that socio-demographic and other contextual factors are different among study population. Moreover, the status of food security might be the reason of difference. In this study, as age increases, prevalence of stunting increases among children. This finding is consistent with the finding of study done in Gojam [27] and Rwanda [28]. The possible difference might be associated with the gradual increase of stunting among children of 6 to 59 months results inappropriate food supplementation during weaning period. Infants should undergo a transition from exclusive breastfeeding to including complementary foods in their diet [22, 29, 30].

On the contrary the current finding is inconsistent to finding of national EDHS study[20], Indonesia [31]. Stunting is a cumulative process that can begin in utero and continues to about three years after birth. Not surprisingly, the finding of this study showed that the risk of stunting increases with age. The result of the study highlights the first two years of life as the most critical period for intervention suggesting an urgent need to institute programs which improve the nutritional status of most vulnerable children in the study area. Such programs are probably most effective if they are instituted among children in the first three years of life. Children younger than 24 months of age responded much more rapidly to the improvement than older children. After a child reaches two years of age, it is very difficult to reverse stunting that has occurred earlier.

Children of uneducated women were more likely to be stunted than their counterparts [32]. This might be related with the fact that education can impact on health and nutritional status of their children. Because, it provides women with necessary skills for child care and awareness of nutritional needs and modern health access [33]. Children live in household with unimproved toilet type were more likely to be stunted than their counterparts [34, 35]. The type of toilet facilities used by a household is an indicator of household wealth as poor households are less likely to have sanitary toilet facilities. This finding is in line with results of Dearden, K. A., et al. (2017) and Khatab, K. (2010) [35, 36]. Children in household which had toilet without hand washing service had more chance to be stunted than their counterparts [37, 38]. This might be explained with the fact that open defecation free status had lower prevalence of diarrhoea cases compared open defecation. This suggests diarrhoea is associated with stunting [39]. Children whose faeces were disposed in open field defecation were more likely to be stunted than their counterparts [40]. This might be associated with lack of access to toilets and other sanitation-related facilities; the practice of open defecation poses severe threats to the overall health of populations, particularly children of the developing countries, through various linkages.

Children whose mother does not wash hand after defecation were more likely to be stunted than their counterparts. This finding is consistent with the previous study conducted in Indonesia[41] and rural India[41]. This might be explained due to the fact that he evidence reviewed suggests that poor WASH conditions have a significant detrimental effect on child growth and development resulting from sustained exposure to enteric pathogens but also due to wider social and economic mechanisms [42].

Limitation

This study had a number of strengths. This study gives the more comprehensive overview of the prevalence and factors associated with (mainly WASH factors) on stunting specifically in this food insecure area with different style of feeding, WASH practice and coping mechanism of food insecurity. The random selection, minimum non response rate and adequate sample size of the study subjects make the findings of this study more generalizable. However, this study cannot address the some factors associated with food availability and accessibility on stunting.

Public Health Implication

The findings of this study indicated that the food security programs should extensively incorporated water, personal hygiene and environmental sanitation condition of the study setting in effective strategy of food security program.

Conclusion

Prevalence of stunting among children of 24 to 59 months is high in the study area. Increase child age, more education, more income, unimproved toilet and hand washing before feeding a child were factors increase stunting among children of age 6 months to 59 months. Environmental sanitation, personal hygiene programs should be strengthened. Furthermore, socio-economic status of women should be improved.

Abbreviations

AOR
Adjusted Odds ratio
COR
Crude Odds Ratio
ODF
Open Defecation Field
CI
Confidence Interval
WHO
World Health Organization.

Declarations

Acknowledgments

Authors would like to thank Hawassa University for providing fund for the study. The authors are grateful to all data collectors and study subjects for their valuable contribution.

Authors' contributions

BW wrote the wrote proposal, study design, execution, and acquisition of data, analysis and interpretation. AT and BT reviewed and approved the proposal, participating in designing the methods, analysis, data presentation and interpretation. All the authors revised, read and approved the subsequent drafts of the manuscript.

Funding

Hawassa university provided fund for this study. The funder had no role in the designing the study and conducting the analysis.

Availability of data and materials

All data generated or analysed during this study are included in this published article.

Ethics approval and consent to participate

The study was approved by Institutional Review Board (IRB) of Hawassa University College of Medicine and Health Sciences. This study was conducted in accordance with the Declaration of Helsinki. Support letter was obtained from Lemo district Health office. All study subjects were informed about the purpose, risks, benefit and confidentiality issues related to the study. Participation was on voluntary basis and written informed consent was obtained from each participant. Verbal informed consent obtained for participants who cannot read and write was approved by Hawassa University College of medicine and health science college Institutional Review Board (IRB). Nutrition and health education was given by the data collectors for households and those mothers who had malnourished children were advised to go to health facilities for further treatment. Written informed consent was obtained from LAR/guardians for participants who cannot read and write and age less than 18 years.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no conflict of interests.

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Tables

Table 1
Children charactestics and socio-demographic factors of mothers/caregivers of children of age 24-59 Months in Lemo district, South Ethiopia, 2019 (n=415).

Variables	Frequency	Percent
Educational status of Mother		
Unable to read and write	162	39
Can read and write	5	1.2
Primary education	170	41
Secondary education	71	17.1
Tertiary education	7	1.7
Mothers' occupation		
House wife	333	80.2
Civil servant	4	1
Merchant	70	16.9
Private organization	8	1.9
Sex of a child		
Male	204	49.2
Female	211	50.8
Child's age in month		
24–35	107	25.8
36–47	149	35.9
48–59	159	38.3
Family size		
Less than five	126	30.4
More than five	289	69.6

Table 2
Environmental condition and hand washing practices of residents of Kebeles in Lemo district (n=415). .

Variables	Frequency	percent
Does household have toilet		
Yes	324	78.1
No	91	21.9
Toilet with hand washing		
Yes	74	17.8
No	341	82.2
Safe water management		
Yes	415	100
No		
Toilet Condition		
Functional	256	61.7
Not functional	159	38.3
Hand washing after defecation		
With water and soap	114	27.5
With water only or does not wash	301	72.5
Hand washing after cleaning child's anus		
With water and soap	241	58.1
With water only or does not wash	174	41.9
Hand washing before eating/ feeding childes		
With water and soap	248	59.8
With water only or does not wash	167	40.2

Table 3. Multivariable logistic regression analysis of factors associated with stunting among under five children in Lemo district South Ethiopia, 2019 (415).

Variables	Stunted	Normal	Crude (95% CI)	Adjusted (95% CI)
Childs age(months)				
24–35	69	38	1	1
36–47	97	52	1.98 (1.2,3.3)*	1.6 (1.1, 7.1)**
48–59	113	46	3.9 (2.3,6.7)*	2.8 (2.1,12.1)**
Mother education				
Educated	19	225	1	1
Uneducated	26	145	2.1 (1.13, 3.97)*	1.8(1.5, 4.2)**
Types of toilets				
Improved	149	87	1.5(1.02, 2.24)*	1.7(1.2,2.6)**
Unimproved	95	84	1	1
Child feces disposal				
Safely	134	34	1	1
Unsafely	142	105	2.9(1.9,4.6)**	2.7(1.6,5.3)**
Hand washing with soap before feeding child				
Yes	236	157	2.6(1.07, 6.41)*	6.2 (2.0, 19.1)**
No	8	14	1	1
Hand washing with soap after defecation				
Yes	23	215	1	1
No	40	137	2.7(1.6,4.7)*	3.1(1.3,8.3)**
Water per day/person/litters				
> 20 Litters	44	200	1	1
< 20 Litters	19	152	0.46 (0.25, 0.84) *	1.13 (0.53, 2.40)
*Significant with P-value < 0.05, **Significant with P-value < 0.001				

Figures

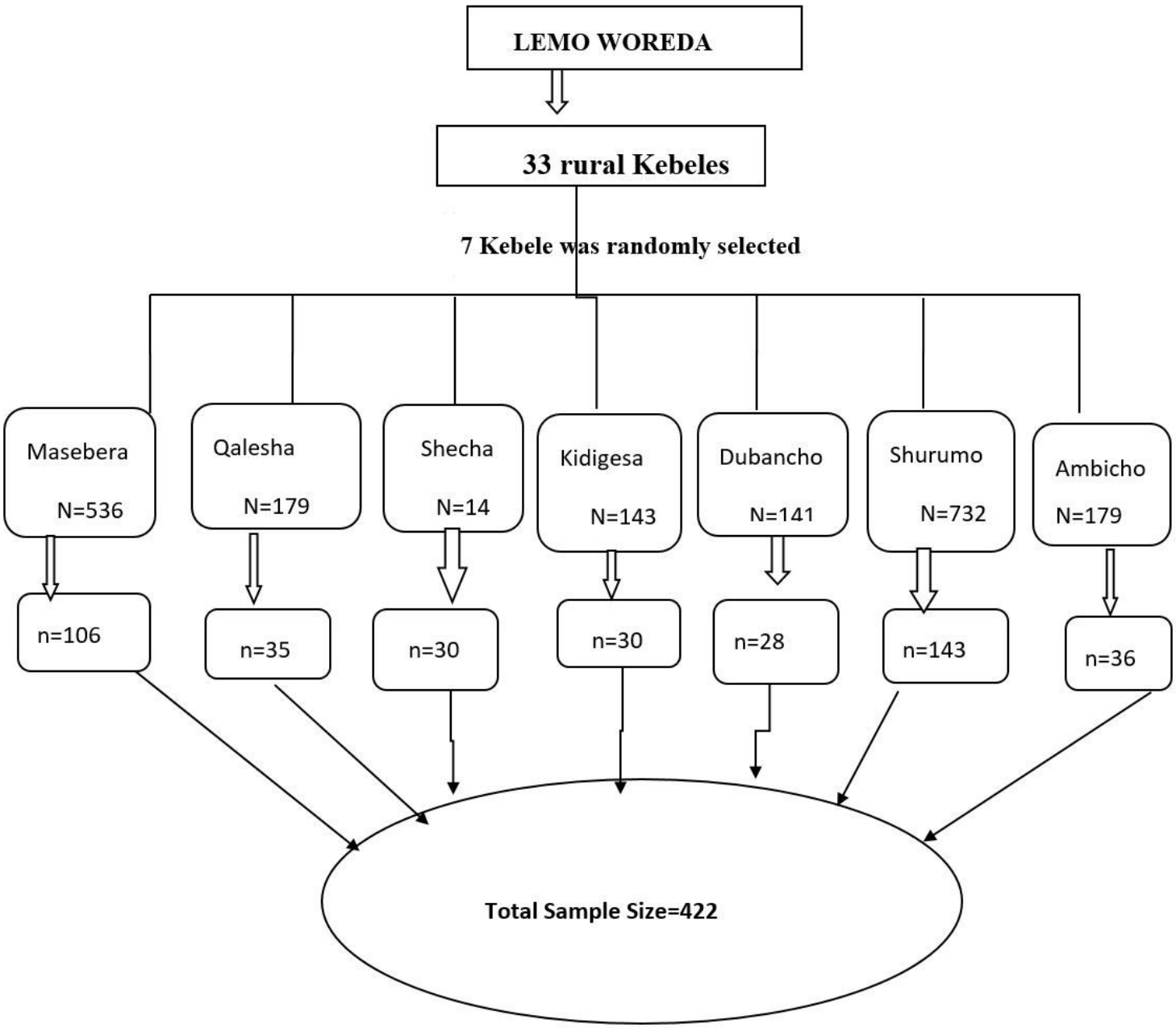

Figure 1

Schematic representation of sampling procedure in Lemo district, Hadiya Zone, South Ethiopia.

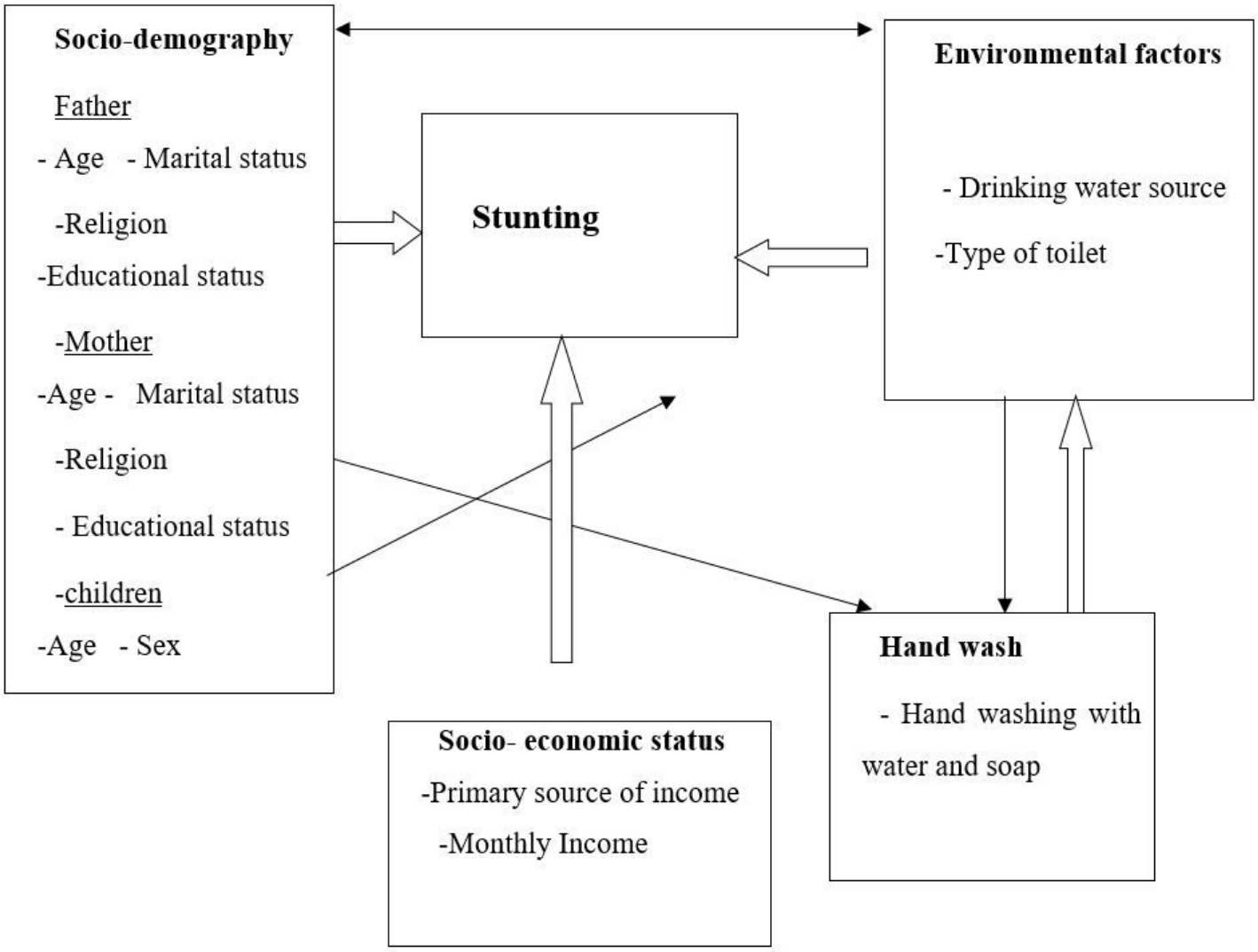

Figure 2

Conceptual Framework for effect of WASH on nutritional status among children aged 24-59 months in rural Kebeles of Lemo District,

Framework

This conceptual framework is proposed after extensive review of different kinds of literature which are mentioned as main factors/determinant of stunting (1-6)

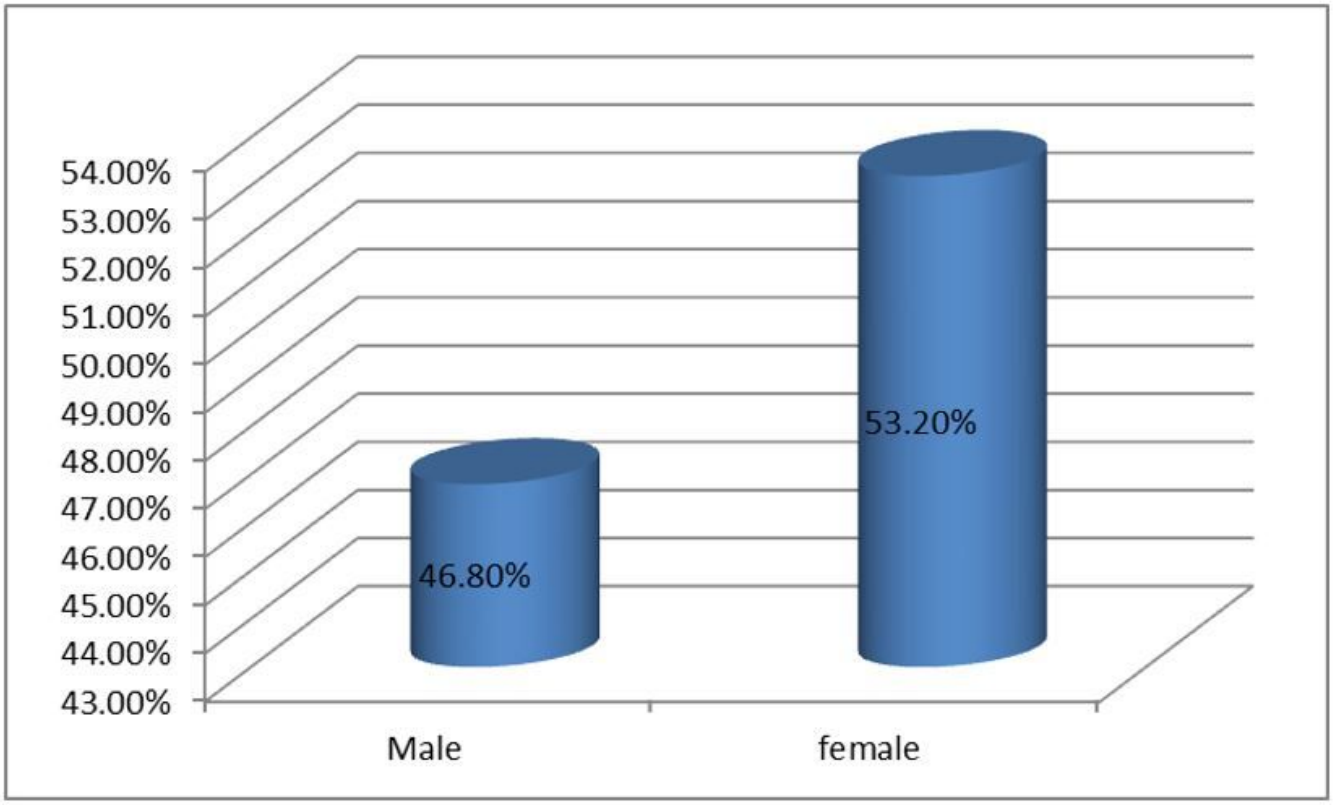

Figure 3

Sex difference of stunting among under-five children in the study area (n=415).