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Original Research Article

Association of Household Hygiene and Sanitation Practices with Odds of Stunting and Underweight Among Infants and Young Children (6-59 Months Old) in Ghana

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Abstract: ***Background*:** Globally, very limited studies have explored the unique contributions of hygiene and sanitation practices on the odds for stunting and underweight in children. Hence, the study examined the relationship between environmental hygiene and sanitation practices and odds for stunting and underweight among children under-five years old in rural communities in Ghana. ***Methods*:** The study was a cross-sectional study, in which study participants were simple randomly selected. All data were gathered from face-to-face interviews and by the use of observational checklist. Data were analysed using statistical product and service solutions software version 21.0. Further, binary logistics regressions model was used to assessed for adjusted odds of stunting and underweight across hygiene and sanitation practice variables. ***Results:*** Upon adjustment for the effects of covariates, children from households with toilet facilities had lower odds for underweight compared with their counterparts recruited from households without toilet facility [0.2(0.0-0.8); p = 0.031]. Also, lower frequency (1-3 times a week) of cleaning toilet facility per week was associated with higher odds for underweight compared with the higher frequency of cleaning (4 times or more per week) of toilet facility [4.5(1.3-15.3); p = 0.018]. ***Conclusions*:** The study revealed that both stunting and underweight were prevalent among the children. Also, inappropriate sanitation and hygiene practices were associated with increased odds for child malnutrition. The district health administration and the district assembly ought to intensify education on the importance of kitchen hygiene and the need for households to own toilet facilities.

Keywords: Hygiene, sanitation, stunting, underweight, Sissala West, Ghana.

INTRODUCTION

Malnutrition is a spectrum of several nutrition consequences as a result of imbalances in nutrition requirements [1]. Globally, malnutrition rates in children are high and pose a major public health burden to nations especially, developing countries [2]. Worldwide estimates of malnutrition among children under 5 years suggest that about 165 million, 99 million, and 51 million are stunted, under-weighted, and wasted, respectively [3, 4]. More importantly, Asian and African countries are the hardest hit [5]. In the past few decades, Ghana has experienced a slow decline in stunting, wasting, and underweight rates, however, a high proportion of these children are still confronted with various forms of growth deficits as a result of malnutrition [6]. For instance, results from a nationwide population-based study show that 19.0%, 5.0% and 11.0% of children under-5 years are stunted, wasted and underweight, respectively [6].

Malnutrition accounts for about 35% of the deaths in under-5 year children [7]. Also, early childhood malnutrition is linked with impaired intellectual performance [8], reduced capacity for physical work [9], and complicated deliveries [10] later in adulthood. The causes of malnutrition in children are complex and intertwined [11-16]. The role of socioeconomic factors, water, sanitation and hygiene (WASH), and infectious diseases have been reported [12-16]. For instance, two previous studies found a positive association between poor child growth and poor sanitation, unhygienic conditions, and the use of unclean drinking water [11, 17]. Also, several studies have been conducted on the relationship between the prevalence of malnutrition and sociodemographic factors among children in

various parts of Ghana [18-23]. In contrast, studies that adjusted for the effects of sociodemographic variables of mother-child pairs allowing for the assessment of an independent effect of household sanitation practices on stunting are scarce [24].

Moreover, assessment of associations between malnutrition indicators among the under-five year olds and sanitation characteristics of the households are often neglected in Ghana especially in rural communities [22]. Therefore, the objective of the study was to assess an independent association of household sanitation practices by adjusting for mother-child pairs socioeconomic variables, and odds of stunting and underweight among under-5-year-old children in rural communities in Sissala West, Ghana.

MATERIALS AND METHODS

This was a descriptive cross-sectional study in which a total of 260 mother-child pairs were simply randomly selected from rural communities in Sissala West District [Gwollu, Fielmuo, Zini, and Jeffisi]. In the study, sociodemographic data of mothers/caregivers and children as well as household asset ownership and conditions of domestic water, sanitation and hygiene (WASH) were assessed using a structured interview guide and an observational checklist. The study was community-based as such, proper community entry protocols were observed with the support of an introductory letter obtained from the Department of Community Health, University for Development Studies, and the District Health Management Team (Sissala West)-Upper West Region. The consent of each of the study respondents was obtained before the commencement of the interview after the purpose of the study was thoroughly explained to them. Further, the respondents were assured of data confidentiality.

Anthropometric Data

Anthropometric measurements [weight (Kg) and length/height (cm)] were taken according to standard procedures [25, 26]. An infantometer was used to measure the length/height of children. Length was measured for children aged less than 2 years whereas and height was measured among those aged 2 years and above. The child's weight was measured using German-made electronic SECA uniscale [maximum allowable load of 150kg, minimum reading of 0.1kg, serial number of 8811021659, and quality control number of 5230]. For the determination of underweight and stunting, the weight-for-age z-scores (WAZ) and height-for-age z-scores (HAZ), respectively. The definitions of underweight and stunting were in accordance with the WHO 2007 growth standards as built into the WHO AnthroPlus software [25]. In the protocol, a z-score < -2 was used to define a height-for-age z-score and a weight-for-age z-score was used to classify children as stunting and underweight, respectively [25-27].

Conditions of WASH and Household Wealth index assessment

The environmental factors assessed in the study include water, sanitation and hygiene-related issues using observational checklist and structured questionnaires. The wealth index of a household was determined by assessing the ownership of their physical assets (durable and semi-durable) [28, 29]. The items assessed were: refrigerator, television, radio/sound system, computer, telephone, mobile phone, bicycle, motorbike, animal-drawn cart, motor tricycle, tractor, and private car/cargo vehicle. To compute a composite index as a proxy for the wealth status of each household, each item owned was assigned a value of one (1) or two (2) depending on its perceived value similar to previous reports [28, 29]. Out of possible total score of 27, the participants were ranked into tertiles: 0-9 [low wealth index (poor)], 9-17 [medium wealth index (moderate wealth)] and 18 – 27 [high wealth index (wealth)]/

Sample Size Computation

Based on standard practices, a sample size was determined from the protocol: $n = [t^2 \times p(1-p)]/m^2$ [30], where n is the required sample size, t is the confidence level at 95% (standard value of 1.96), p is the estimated prevalence of stunting in the study area, which is 20 % based on a previous report [31], and m is the margin of error set at 5% (standard value of 0.05). Therefore, a total sample size of 260 caregiver/child pairs was recruited for the study.

Data Analysis

Data were analyzed using two software thus, WHO AnthroPlus [25] and the International Business Machines Corporation's Statistical Product and Service Solutions (IBM SPSS) version 21.0. The Z-scores for the classification of child nutritional status were determined using the WHO AnthroPlus [25, 27]. The IBM SPSS was used to calculate the distribution of socio-demographic characteristics of respondents and their children. The unadjusted odds ratios of stunting and underweight were calculated per the exposure variables (parameters of WASH) in model 1 using the binary logistics regression technique. However, in model 2, the adjusted odds of stunting and underweight were computed by controlling for the effects of the sociodemographic variables (confounding factors) of mothers and their children in the binary logistics regression model. For the test of associations, p-value < 0.05 was considered to be a statistically significant relationship.

RESULTS

The socio-demographic background information of caregivers gathered from the study showed majority (95.4%) of the 260 caregivers interviewed were females. Regarding the age distribution of the respondents, the minimum and maximum ages were 19 and 51 years, respectively, with a mean (± standard deviation) of 30.03±6.55 years. Moreover, majority (58.8%) were within the ages of 25 to 36 years (Table 1). Also, majority of the caregivers interviewed were Muslims (90%) and were from the Sissala ethnic group (88.1%). A large proportion (90%) of the respondents were married. With the household size of respondents, majority (58.1%) within the range of 5-8 persons (Table 1).

Table 1: Distribution of Socio-demographic Characteristics of Respondents

Variable	Frequency	Percentage (%)
Sex of respondent		
Male	12	4.6
Female	248	95.4
Total	260	100.0
Age group of respondents		
19 – 24	64	24.6
25 – 30	77	29.6
31 – 36	76	29.2
37 – 42	34	13.1
43 – 51	9	3.5
Total	260	100.0
Religion of respondent		
ATR	10	3.8
Christianity	21	8.1
Islam	229	88.1
Total	260	100.0
Ethnicity of respondent		
Sissala	229	88.1
Dagaaba	28	10.8
Others	3	1.1
Total	260	100
Marital status of respondent		
Never married	2	0.8
Married/living together	234	90
Divorced/separated	12	4.6
Widow/widower	12	4.6
Total	260	100
Household Size category		
2 – 4	47	18.1
5 – 8	151	58.1
9 – 11	54	20.8
12 – 14	8	3.1
Total	260	100.0

Of all the children enrolled in the study, majority (55%) were females, with 6 and 59 months as the minimum and maximum ages, respectively. Also, the mean ± standard deviation of their ages was 20.89±12.83 months (Table 2).

Table 2: Distribution of Socio-demographic children

Variable	Frequency	%
Sex of child		
Male	117	45.0
Female	143	55.0
Total	260	100.0
Age category of the children		
6 – 8	48	18.5
9 – 11	28	10.8
12 – 17	51	19.6
18 – 23	32	12.3

Variable	Frequency	%
24 – 35	61	23.5
36 – 47	28	10.8
48 – 59	12	4.6
Total	260	100.0

The anthropometric data of the under-five year old children gathered helped to determine their nutritional status by computing the two most common indicators with the potential of revealing chronic malnutrition and acute malnutrition (height-for-age, and weight-for-age z-scores). With the height-for-age (HAZ) classification, 85.0% had a normal nutritional status (-2≤ z-score ≤ 2), with 15% being stunted (z-score <-2). With the weight-for-age z-scores (WAZ) classification, 89.6% of the children were found to be normal (-2≤ z-score ≤ 2), whereas, 10.4% were said to be underweight (z-score <-2) (Table 2).

Table 3: Distribution of Nutritional Status of Under-five Children

Variable	Frequency	%
Height-for-age Z-score (HAZ)		
-2 ≤ z-score ≤ 2 (normal)	221	85.0
-3 ≤ z-score <-2 (moderate stunting)	30	11.5
x < -3 (severe stunting)	9	3.5
Total	260	100.0
Weight-for-age Z-score (WAZ)		
-2 ≤ z-score ≤ 2 (normal)	233	89.6
-3 ≤ z-score <-2 (moderate underweight)	25	9.6
x <- 3 (severe underweight)	2	0.8
Total	260	100.0

Table 4 below illustrates the results for the odds of stunting according to WASH variables. In the unadjusted model, the use of unclean cooking utensils compared with the use of clean cooking utensils was associated with higher odds of stunting [2.2(1.3-4.5); p = 0.047]. However, the relationship was no more significant [1.9(0.7-4.8); p = 0.206] upon an adjustment for the effects of sociodemographic covariates [maternal age, religion, ethnicity, marital status, sex of child, household size, maternal educational status occupation, and household wealth index]. Conversely, the odds of stunting were not significantly associated with the other environment and sanitation variables (see Table 4).

Table 4: Odds of stunting according to WASH variables.

Variable	Unadjusted OR [95%CI]	P	Adjusted OR[95%CI]	P
Indiscriminate waste disposal: [Yes (1); No (0)]	1.1[0.6-1.6]	0.748	0.9[0.4-2.1]	0.896
Has toilet in the house: [Yes (1); No (0)]	1.4[0.7-2.8]	0.506	1.3[0.3-6.0]	0.722
Practicing open defecation: [Yes (1); No (0)]	1.1[0.6-2.3]	0.857	0.8[0.2-3.6]	0.735
Handwashing practice: [Sparingly/Habitual; Yes (1); No (0)]	1.4[0.7-2.8]	0.486	1.1[0.4-2.8]	0.854
Daily handwashing with soap under running water: [Yes (1); No (0)]	0.7[0.4-1.5]	0.506	0.5[0.2-1.2]	0.129
Frequency of sweeping immediate surroundings in a day: [once (1); more than once (0)]	1.3[0.6-2.9]	0.613	1.1[0.4-3.1]	0.875
Immediate surrounding is dirty: [Yes (1); No (0)]	1.8[0.8-4.0]	0.193	1.8[0.6-5.1]	0.280
No good drainage System: Yes (1); No (0)	2.4[1.2-5.0]	0.024	1.8[0.7-4.5]	0.194
Frequency of cleaning kitchen daily: [once (1); Twice or more; once (0)].	1.5[0.4-5.8]	0.792	1.5[0.3-7.5]	0.637
Kitchen environment: [Clean (1); dirty (0)]	1.0[0.5-2.1]	1.000	0.4[0.1-1.2]	0.096
Utensils are not kept clean: [Yes (1); No (0)]	2.2[1.3-4.5]	0.047	1.9[0.7-4.8]	0.206
Frequency of cleaning bathroom/toilet: [1-3 times a week (1); 4 times or more per week (0)]	1.3[0.6-2.5]	0.624	1.4[0.6-3.4]	0.463
Child's bathing frequency in a day: [Once (1); Twice or more (0)]	1.3[0.5-3.6]	0.845	1.5[0.5-5.0]	0.477

P: statistical significance level; Model 1: unadjusted. Model 2: adjusted for maternal age category [19-30 (1); (31-51 (0)], religious status: [Islam (1); Christianity (0)], ethnicity: (Sissala (1); Dagaaba & others (0)] marital Status: [married or living together (1); not married (0), sex of child: [male (1); female (0), child's age category: [6-23 (1); 24-59 (0)], household size: (2-4 (1); 5-14 (0), maternal educational status: [JHS & above 1); No formal or primary (0)], occupational status mother: professional & skilled manual (1); farming & unskilled manual (0), household wealth index: high wealth index (0); Low wealth index (0)]. Coding for stunting: [present (1); absent (0)].

Table 5 below illustrates the results for the odds of underweight according to WASH variables. Upon the adjustment for the covariates [maternal age, religion, ethnicity, marital status, sex of child, household size, maternal educational status occupation, and household wealth index], the odds of underweight were significantly lower among households with a toilet facility compared with those without a toilet facility [0.2(0.0-0.8); p = 0.031]. Similarly, a lower frequency (1-3 times per week) of cleaning toilet facility compared with the higher frequency of cleaning (4 times or more per week) was associated with higher odds for underweight in both the unadjusted [2.9[1.2-6.9); 0.022] and the adjusted [4.5(1.3-15.3); p = 0.018] models. The other variables of sanitation did not show a significant relationship with the odds of being underweight.

Table 5: Odds of underweight according to WASH variables.

Variable	Unadjusted OR [95%CI]	P	Adjusted OR[95%CI]	P
Indiscriminate waste disposal: [Yes (1); No (0)]	0.9[0.4-2.1]	0.991	0.5[0.2-1.6]	0.262
Has toilet in the house: [Yes (1); No (0)]	1.1[0.5-2.4]	1.000	0.2[0.0-0.8]	0.031
Practicing open defecation: [Yes (1); No (0)]	2.0[0.8-5.2]	0.209	4.6[0.7-29.2]	0.109
Handwashing practice: [Sparingly; Habitual; Yes (1)/No (0)]	1.1[0.5-2.6]	1.000	0.6[0.1-2.1]	0.390
Mode of handwashing: with soap under running water/anyhow: [Yes (1); No (0)]	1.8[0.8-4.1]	0.193	1.6[0.5-5.1]	0.392
Frequency of sweeping immediate surroundings in a day: [(1); more than once (0)]	1.7[0.7-4.2]	0.343	1.2[0.3-4.6]	0.833
Immediate surrounding is dirty: [Yes (1); No (0)]	1.3[0.5-3.3]	0.831	1.1[0.3-4.7]	0.902
No good drainage System: [Yes (1); No (0)]	2.4[1.0-5.6]	0.075	3.4[0.9-12.0]	0.061
Frequency of cleaning kitchen daily: [once (1); Twice or more/once (0)].	2.5[0.7-9.7]	0.346	2.4[0.3-18.3]	0.400
Kitchen environment: [Clean (1); dirty (0)]	1.7[0.7-3.8]	0.332	0.8[0.2-3.2]	0.788
Utensils are not kept clean: [Yes (1); No (0)]	1.9[0.8-4.3]	0.171	1.1[0.3-4.0]	0.910
Frequency of cleaning bathroom/toilet: [1-3 times a week (1); 4 times or more per week (0)].	2.9[1.2-6.9]	0.022	4.5[1.3-15.3]	0.018
Child's bathing frequency in a day: [Once (1); Twice or more (0)]	1.6[0.5-5.0]	0.643	1.3[0.3-5.7]	0.736

P: statistical significance level; Model 1: unadjusted. Model 2: adjusted for maternal age category [19-30 (1); (31-51 (0)], religious status: [Islam (1); Christianity (0)], ethnicity: (Sissala (1); Dagaaba & others (0)] marital Status: [married or living together (1); not married (0), sex of child: [male (1); female (0), child's age category: [6-23 (1); 24-59 (0)], household size: (2-4 (1); 5-14 (0), maternal educational status: [JHS & above 1); No formal or primary (0)], occupational status mother: professional & skilled manual (1); farming & unskilled manual (0), household wealth index: high wealth index (0); Low wealth index (0)]. Coding for underweight: [present (1); absent (0)].

DISCUSSION

Globally, malnutrition rates are high [2]. For example, about 165 million stunted, 99 million under-weighted, and 51 million wasted children [3, 4], including Africa [5]. In this study, the indicator with the highest prevalence was stunting followed by underweight, as 15% of the under-five children enrolled in the study were found to be stunted, 10.4% being underweight. Compared with previous findings from other countries in Africa, the present prevalence of stunting (15%) and underweight (10.4%) are relatively low. For example, previously, a relatively higher prevalence of stunting was found in Democratic Republic of Congo (42.7%), Mali (38.3%), Burundi (57.7%), Niger (43.9%), Sierra Leone (37.9%), Malawi (47.1%), Nigeria (36.8%), and Chad (39.9%) [5]. Also, compared with the present prevalence of underweight (10.4%), a more higher prevalence was reported in Ethiopia (25.2%), Nigeria (28.7%), and Burkina Faso (25.7%) [5]. However, the rates of stunting (15%) and underweight (10.4%) in the present study were higher than the results of the most recent national data for stunting (19 %) underweight (11%) [6]. The conflicting results as outlined above may partly be accounted for by variations in the study designs particularly, the sample size.

Sociodemographic characteristics of mother-child pairs are important determinants of the child's health and nutritional status [1, 11, 24]. Therefore, adjustment for the effects of sociodemographic factors of mothers and their children may be the best approach to evaluating the unique relationship between hygiene and sanitation factors and children's nutritional status [24]. This is because the importance of environmental factors on the nutritional status of under-five children cannot be downplayed as seen in several researches [32]. In the present study, in the unadjusted model, unhygienic cooking utensils are associated with higher odds of stunting. However, upon adjustment for the effects of mother-child pair sociodemographic characteristics, the relationship was not more significant although the unhygienic utensil use was still associated with higher odds for stunting. After the adjustment for covariates, the odds of being underweight among children from households without toilet facilities were higher compared with those from households with toilet facilities. Similarly, in three previous observational studies household access to toilet facilities was said to

have a statistically significant association with the stunting of children under-two years, this study found the availability of toilet facilities in the household not to have any statistically significant influence on stunting [33, 34] and other malnutrition indicators [35]. In another observation study, after the authors' adjustment for covariates open defecation was associated with increased risk for stunting [24]. Further, several other studies (Rah *et al.,* 2015; Ngure, 2014; Dangour *et al.,* 2013; Liu *et al.,* 2012) have linked unhygienic practices with child malnutrition [32, 33, 36, 37].

Strategic interventions for the prevention of malnutrition targeting various segments of the national population including children under-five years old ought to be a national priority. This could reverse the consequences of childhood malnutrition.For instance, malnutrition of under-5 year children is one of the main causes of the deaths of children in developing countries [38] as it accounts for about 35% deaths among this age group [7]. Nutritional inadequacies at early at stages of life are also linked to growth impairment and adverse health status. Stunting is the result of malnutrition in the first two years of life, with with subsequent short stature in adulthood [39]. It has been proven that adults who have impaired intellectual performance had suffered malnutrition in early childhood [8]. Such adults in other reports may also have reduced strength for physical activities [9], poor reproductive capacity, and unfavorable birth outcomes including low birth weight [10].

CONCLUSION

The findings of the study revealed that stunting and underweight were prevalent among the children. Moreover, insanitary conditions were found to be associated with higher odds of child malnutrition. The district health administration and the district assembly ought to intensify education on the importance of kitchen hygiene and the need for households to own toilet facilities.

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