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Inappropriate complementary feeding and Water, Sanitation and Hygiene induced prevalence of child malnutrition in Jirapa municipality

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Abstract

Child malnutrition is a major public health problem especially in Africa. The causes of under nutrition are multifaceted and vary according to geographical locations. It is known that, many infant mortalities are attributable to malnutrition induced inappropriate water, sanitation and hygiene practices. Using a cross-sectional community-based research design, the study assessed the effects of inappropriate complementary feeding and poor water, sanitation and hygiene practices on the nutritional status of children aged 6-23 months in Jirapa Municipality. A population of 301 mothers with children 6-23months were evaluated. A stratified sampling procedure was used to stratify the sub districts and a simple random sampling was used to select the communities and study participants. The Prevalence of malnutrition in the municipality stood at 11.3% for wasting, 14% for stunting and 18.6% for underweight respectively. The practices of timely introduction of complementary feeding, minimum meal frequency and minimum dietary diversity score of at least four food groups were 88%, 52% and 24 % respectively among study population. The practice of appropriate complementary feeding was 17.0 %. Also, Household access to quality drinking water, access to hygienic latrines, practices of good hygiene and sanitation were 92.7%, 29.6% and 38.2% respectively. In all, the Score for good water, sanitation and hygiene practices was 40.2%. Relatively, inappropriate complementary feeding [AOR 8.09; 95 %CI (1.06 – 60.70)], Household wealth status [AOR 8.37; 95 % CI (2.85 – 24.59)], child age (9-11months and 12-23months) [(AOR = 7.72, CI = 1.83 – 32.59, P = 0.005) AOR = 3.91, CI = 1.12 – 13.63, P = 0.032)] were independent predictors of stunting. Additionally, households' wealth was the only strong predictor of wasting [AOR 4.17; 95 % CI (21.56–11.17)]. Therefore, behavioural change and communication involving all the stakeholders on complementary feeding and water, sanitation and hygiene practices among pregnant women should be encouraged.

Keywords: Complementary, Feeding, WASH, Malnutrition, Wasting, Stunting

1. Introduction

Indications of child malnutrition takes the form; fetal growth restrictions, stunting, wasting, and some micronutrients deficiencies like vitamin A and zinc, together with suboptimal breastfeeding. These contribute to nearly 3.1 million deaths (representing about 45% of all deaths) of children less than 5years annually worldwide (Bhutta *et al*., 2013) [7]. In addition, about 165million children less than 5years are stunted in their growth with about 52 million suffering from severe malnutrition (Bhutta *et al*., 2013) [7]. Indeed, child under nutrition is a major public health problem especially in Africa (Frison *et al*., 2016) [14]. The Sub-Saharan Africa has one of the highest burdens of child malnutrition globally (Akombi *et al*., 2017) [4]. In the Upper West Region of Ghana where this study will be conducted, the prevalence of stunting is estimated as 22.2% as well as 13.5% for underweight (GSS, 2014). The Upper West Region recorded 73.8% of children aged 6-59 months been anaemic (GSS *et al*., 2014). It is one of the poorest performing regions in terms of child malnutrition and among the three regions with the highest Under-5 mortality in Ghana (GSS, 2014). It recorded the highest infant mortality of 64 deaths per 1,000 live births (GSS, 2014). The first 1000 days of life (0-23months) is a very critical phase in the development of a child's life. Primarily, poor nutrition within this period is greatly associated with suboptimal brain development, which negatively affects cognitive development, educational performance and economic productivity of adults (Akombi *et al*., 2017) [4]. More importantly, the

consequences of malnutrition at the early stages of life are irreversible and this often leads to an increased risk of morbidity and mortality in children (Akombi *et al*., 2017) [4]. Poor nutritional status in early childhood development contributes a lot to growth faltering (Kuchenbecker *et al*., 2017) [25]. The causes of under nutrition are multifaceted and vary according to geographical locations but poor feeding practices and sanitary practices contribute to this. It has been hypothesized that Infant and Young Child Feeding practices (IYCF); particularly dietary diversity could be a better indicator of determining micronutrient adequacy which may be more critical for the subsequent growth of young child (Mallard *et al*., 2016). However, in Ghana, fifty-two percent of children younger than 6 months were exclusively breastfed and only 13 percent of children age 6-23 months met the minimum standards set by three IYCF practices (GSS *et al*., 2014). Globally, about 32% of the world population lacks access to adequate sanitation. About 9% of the world population lacks access to safe drinking water (United Nations, 2016) and this could contribute to infections especially at the household level: For example, in the Jirapa Municipal of Ghana, about 81.0% of the households do not have toilet facilities in their homes and therefore resort to open defecation (Ghana Statistical Service, 2014) [16]. Most households (44.8%) indiscriminately dump their solid waste. 34.5 percent practice public dumping of their solid waste in the open space. House to house waste collection accounts for 3.5 percent. For liquid waste disposal, throwing waste onto the street (69.9%) and onto the compound (24.4%) are the two most common methods used by households in the district (Ghana Statistical Service, 2014) [16].

Despite efforts of Ghana Health Service (GHS) and its partners over the years implementing interventions such as High Impact Rapid Delivery Strategy (HIRD) since 2006, the community-infant and young feeding practices (IYCF) since 2012, Growth Monitoring and promotion (GMP) since the early 1990s among others in the Jirapa district, all forms of malnutrition are consistently and prevalently high. Ironically, poor child feeding practices and poor child nutritional status remain high in many parts of the district. Furthermore, reported cases of foeco-oral diseases in the district point to the fact that the district is not spared the consequences of poor environmental sanitation. It is undeniable fact that quality of water, sanitation and hygiene (WASH) influences a child nutritional status. Unsafe water usage, unimproved sanitation, and improper hand washing practices, together contribute to stunting, mainly through the repeated diarrhoea, infection, reduced immunity, nutrient loss and decreased nutrient absorption. Little information is however available about the independent and joint contribution of these determinants to the persistent high levels of child under nutrition in Jirapa Municipal. In the light of these, the paper sought to examine the influence of inappropriate complementary feeding practices to the nutritional status of the children in the district.

2. Review of related literature

The challenges that confront complementary feeding and WASH practices are context specific; however, many are common across different settings. The determinants of optimal feeding practices in the study areas are multidimensional and include many interrelating factors such as socio-economic aspects, agricultural practices, household demographics, cultural practices and geography.The most dominant determinants has to do with poor feeding practices and poor dietary quality of local made complementary foods Household food security and Socio-economic and demographic characteristics of family or a community can influence the initiation and practice of optimal complementary feeding (Lutter, *et al*. 2013 [27]; Agedew, *et al*. 2014). Poor feeding practices are bedevilled by inappropriate timing of complementary foods; introduction (too early or too late); poor in meeting the minimum meal frequency; and poor feeding methods, hygiene, and child-care practices (Abeshu *et al*., 2016). In addition, the poor dietary quality of the foods served, characterized as too little variety; inappropriate consistency (food is too thin or too thick); too few essential vitamins and minerals, especially vitamin A, iron, zinc, and calcium; too few essential fatty acids; and too few calories among non-breastfed infants (Abeshu, 2016). The poor quality and lack of diversity in foods adversely affects the children's growth and nutritional status. Complementary feeding should be initiated timely and must be adequate in terms of amounts, frequency, consistency, and diversity of food (Shumey,*et al*. 2013) [39]. The foods should be adequately prepared and child taken in a safe manner. Also, the food should be given in a way that is appropriate in terms of texture for the age of the child. It is also essential to apply responsive feeding following principles for psychosocial care (Khokhar *et al*. 2017) [23]. In many countries, the period of complementary feeding from 6–23 months is the time of peak incidence of growth faltering, micronutrient deficiencies and infectious illnesses. In another study, it was found that maternal knowledge had significant relationship with child feeding practices. There was a significant increase of the practice of breastfeeding (87.3%); timely introduction of complementary foods (85.4%) and accurate meal frequency for age (74.5%) was high (Korir, 2013) [24]. Also, mothers having primary, secondary and above education, receiving postnatal care, possession of radio and giving birth at hospital were found to be independent predictors for complementary feeding practices (Demilew *et al*., 2017) [10]. An assessment of minimum dietary diversity and meal frequency in Northwest Ethiopia found that the proportion of children who met these feeding practices were 12.6% and 50.4%, respectively. Maternal educational status, age of a child and others were positively associated with dietary diversity. Moreover, age of the child, mothers involvement in decision making and others were also associated with meal frequency (Beyene *et al*., 2015) [6]. To add on, another cross-sectional study revealed an unacceptable level of IYCF practices and the following factors were associated with the abysmal performance; maternal age, low maternal education, poor household wealth status, and unemployment (Khan *et al*., 2017) [22]. It was reported in a study that about 43.5% of mothers have their children received complementary food inappropriately. In fact, mothers' occupation, public media exposure, role of mother in making decision on how the household money is used and postnatal care service, were statistically significant associated with inappropriate complementary feeding practices (Molla *et al*., 2017) [33]. In a study, the bivariate analysis indicates that children related issues, maternal education and household characteristics like maternal Body Mass Index (BMI), wealth index, place of residence, feaces disposal, time to get water were associated with WASH

practices (Wondimu, 2016) [45].

3. Methodology

3.1 Study area

The study was conducted in the Jirapa Municipality of the Upper West Region with 141 communities.There are seven (7) sub-municipals administratively managed by Sub-Municipals Health Teams (SMHTs). Each sub-district is divided into CHPS zones for community health service delivery. The district has a polyclinic, a Hospital, 8 health centers and twenty-two Community-Based Health Planning and Services. The nutrition surveillance took place in all the 7 sub-municipals. The sub municipals are Jirapa Urban Sub, Sabuli Sub, Ullo Sub, Hain Sub, Tuggo sub, Yagha Sub and Duori Sub. In 2017, the entire population of the municipality is estimated to be 101,899 while the under-five population for the district is estimated to be 18,341 [18%]. Comparatively, Jirapa recorded the second highest still birth rate of 1.8 per 1000 live births after Wa Municipal but recorded the highest rate of 23.6 /1,000 LBS (56/2,368 LBS) of neonatal mortality. It again recorded the highest rate of 26.6 (63/2,368 LBS) of institutional infant mortality as well as recorded the highest of 32.1/1,000 LBS (76 Deaths) of institutional under-5 mortality. Asphyxia, preterm delivery, low birth weight severe anaemia among others were the causes of these deaths (GHS-RHD, 2016).

3.2 Study design

An analytical community-based cross-sectional design was used. The investigator measured the outcome and the exposure(s) in the population, and studied their association at the same point in time (Setia, 2016).

3.3 Study population

All eligible children aged 6-23months and their mothers who are within their fertility age from a household were recruited for the study. Mothers of such children were interviewed to ascertain their sanitation, water and hygiene bahaviours and how in appropriate complementary feeding practices affect the nutritional status a child. The study was purely community based and therefore, the study was limited to communities in Jirapa. The study excluded participants who were not willing to participate in the investigation, seriously sick child and care givers who were not available to respond to the checklist. A multistage sampling procedure was used in this study. A stratified sampling procedure was used to stratify the sub districts where each of the seven sub districts constituted a stratum. A simple random sampling procedure was used to select the communities within each stratum for the study. This was randomly done using the ENA sampling software. In the selection of the study participants, only one eligible respondent was selected using a simple random sampling to be interviewed in a household. A comprehensive list of all households that constituted the sample frame was compiled from a chosen cluster and systematic sampling technique was used to select the study household. Scientifically all the selected households were numbered serially in order to determine the sampling interval by dividing the sample frame with a sample size of 10 per cluster. At random the first household was selected by choosing any number within the sample interval. In order to visit the next household, it was determined by adding the sampling interval to the selected number. However, if eligible respondents were not found in a selected household, the same systematic sampling procedure was used to select the next household. This procedure was used until the exact sample size was obtained.

3.4 Sample size

The size of the sample was scientifically estimated using the Cochran's formula for calculating sample size (Greene, 2012) as; Cochran's formula: $n_o = Z^2 * pq/(D)^2$, Where Z= value of selected alpha level (Z-score that corresponds with confidence interval) =-1.96, no = required return sample size, p= proportion of children stunted -0.222, q= proportion of children that are not stunted-0.778 (q=1-P), D= acceptable margin of error in mean 0.05. Therefore, at 95% confidence level, the alpha value is 0.05 with the corresponding Z-score 1.96. Given the regional prevalence of stunting at 22.2% among children 0-59months. The appropriate sample size for the study was estimated at;

$n_o = (1.96)^2 * (0.222 * 0.778/(0.05)^2 = (3.8416 * 0.172716)/0.0025 = 265$.

In addition to the 10% non-respondent rate, the entire sample size is 300.

3.5 Data collection methods

The data on the inappropriate complementary feeding and WASH practices was collected from the mothers/caregivers using a structured questionnaire which was administered through a face-to-face interview when the households were being visited. The socio-demographic and economic features of the participants, young child feeding practices, child's age, gender, mothers educational level, illness in the past two weeks, mothers WASH practices, mother and child anthropometries constituted the questionnaire and data on this was collected.

3.6 Independent and dependent variables

Inappropriate complementary feeding and WASH were the independent variables. The Indicators for assessing IYCF practices published by WHO in 2010 was used to assess the appropriateness of the complementary feeding (WHO, 2010). The following measures of complementary feeding indicators were included in the study and were assessed using the 24hr dietary recall (food and liquid consumption):

a. introduction of solid, semisolid or soft foods;
b. minimum dietary diversity;
c. minimum meal frequency; and
d. minimum Acceptable Diet;

a) **Introduction of solid, semi-solid or soft foods:** Proportion of infants 6–8 months of age who receive solid, semi-solid or soft foods.
Infants 6–8 months of age who received solid, semi-solid or soft foods during the previous day
Infants 6–8 months of age

b) **Minimum dietary diversity:** Proportion of children 6–23 months of age who receive foods from 4 or more food groups. The seven food groups used for tabulation of this indicator were:

1. Grains, roots and tubers
2. Legumes and nuts
3. Dairy products (milk, yogurt, cheese)
4. Flesh foods (meat, fish, poultry and liver/organ meats)
5. Eggs
6. Vitamin-A rich fruits and vegetables

7. Other fruits and vegetables

Children 6–23 months of age who received foods from ≥ 4 food groups during the previous day
Children 6–23 months of age

c) **Minimum meal frequency:** Proportion of breastfed and non-breastfed children 6–23 months of age, who receive solid, semi-solid, or soft foods (but also including milk feeds for non-breastfed children) the minimum number of times or more. the minimum number of times or more (i.e., two times for breastfed infants aged 6–8 months, three times for breastfed children aged 9–23 months and four times for non-breastfed children aged 6–23 months, on the previous day). Meals include meals as well as snacks (other than trivial amounts), and frequency was based on care-giver report.

d) **Minimum acceptable diet:** Proportion of children 6–23 months of age who receive a minimum acceptable diet (apart from breast milk). The indicator was calculated from the following two fractions:

Breastfed children 6–23 months of age who had at least the minimum dietary diversity and the minimum meal frequency during the previous day
Breastfed children 6–23 months of age

and

Non-breastfed children 6–23 months of age who received at least 2 milk feedings and had at least the minimum dietary diversity not including milk feeds and the minimum meal frequency during the previous day
Non-breastfed children 6–23 months of age

WASH parameters that were assessed included access to and use of safe drinking water, availability of sanitation facilities (e.g., latrines) and sanitation together with good hygiene practices (e.g., hand washing with soap at critical times). Both Water quantity in terms available facilities and services that increase the amount of water available as well as Water quality in terms of availability safe water. Sanitation in terms of provision and use of infrastructure and services that aid safe disposal of human urine and faeces. Hygienic practices may include personal hygiene such as hand washing with soap especially after defecation or disposal of child faeces, food hygiene and environmental hygiene. The principal dependent variable was the child malnutrition status which was measured as length -for-age Z-score (LAZ), weight-for- length Z-score (WLZ), weight for-age Z-score (WAZ), Child's Mid Upper Arm Circumference. These were translated into categorical variables such LAZ for stunting, WLZ for wasting or MUAC and WAZ for underweight if these fell below −2 standard deviations of the population median. Data was also collected on the care givers socio-economic status, demographic variables, maternal health and education, food security, Exclusive breastfeeding, morbidities utilization prenatal care which may serve as confounders.

3.7 Instrument administration procedure

The questionnaires were personally administered in a face-to-face interview by the researcher and his assistants to the respondents. Ample time was given to the respondents to study the pattern of the instruments and to answer appropriately without being rushed. Respondents preferred choices were ticked. However, instances where respondents cannot read and write, the data collector read out to the respondent in a language that he/she understood. This strategy was adopted since not all the respondents were able to read and write. Five research team (2 anthropometric collectors, 3interviewers) went to the households' level to introduce themselves to the household members and to collect the data. All protocols were observed by the researcher and his team in terms of seeking for consent and permission both at the community and households level. The researchers interviewed and collected anthropometric data from 301 caregivers and their children aged 6-23months. The questionnaire was administered first followed by the collection of the anthropometric data.

1. It was critical for the team to identify eligible children by checking records like child health records booklet as well as observation and being vigilant to exclude sick children and other non-eligible children
2. Mothers of the children were interviewed on their socio-demographic and economic status, complementary feeding and WASH practices, food security, maternal and child morbidities through face-to-face interaction.
3. Thirdly, the mother anthropometric data (weight and height) were taken
4. Also, child anthropometric data (weight, height, age and MUAC) were also taken.
5. Secca's Infantometer, Digital Bathroom Weighing Scale, MUAC tape and questionnaire were the components of the data collection tools.
6. The weighing scale was standardized daily
7. The height was taken by two data collectors

3.8 Quality control

Tremendous effort was made by the researcher to ensure the validity of the data collection instrument and the entire process. The validity test was ran to test the degree of precision of the data collection tool. Also, exiting literature were thoroughly reviewed to guide in the construction of the research instrument. The instrument was evaluated by the supervisor and technical persons and inputs made were inserted. Steps were taken to ensure data quality and avoid confounders. Errors, completeness and consistency were immediately checked on daily basis. The questionnaire was thoroughly checked for completeness before data was entered. Data entry began immediately after the data collection was over. The data was checked to avoid double data entry. The questionnaire and other data collection tools were well rehearsed during the data collection training. Data collectors translated and interpreted each question into the local language especially the nutrition and health technical wordings. Checking the validity, the study took a precision of $+\_5$. Interviewers' especially Senior High schools and tertiary graduates were recruited for the administration of the questionnaire. Five data collectors were recruited. They undergone three days training to equip themselves with data collection techniques especially taking anthropometric data, content of the data collection instrument and on general underlying principles of data collection.

4. Results

4.1 Socio-economic characteristics of respondents

Table 4.1 shows that, majority of the study subjects were Christians with few other participants being been Muslims and traditionalists. The study found large proportion of the study participants not attaining any level of formal education. About42.5% had at most basic level education while 3.7% had at least second cycle education. Again, the results put forward that majority, 95.3% of the respondents were married and almost all the respondents were Dagaaba/Wale with 2.7% been Fulani's. Aside the respondents being housewives, majority were engaged in agricultural activities to earn some income. Close to 34% and 39% were engaged in either providing services like hairdressing, seamstresses etc. or engaged in trading to earn income respectively. Smaller proportions of the respondents were either civil servants or public servants like health workers, teachers etc. From table 4.2, majority (94.4%) of the respondents were within the age category of 18-34 years. The birth spacing from the survey indicates that majority of the household has one to two children less than 5years while 7.6% of the households with at least three children less than 5years in the study area. Also, the results found husband or male partner in a household highly responsible for taking or making decisions in relation to family food issues and WASH practices. On the household wealth index classification, majority of the households were below the 50% average wealth index while close to 40.5% were above the average wealth index. Majority (92.7%) of mothers' made ≥4antenatal visits to the appropriate health facility for services. On the place of delivery, an encourageable result of 94.4% had delivery at the health facility.

Table 1: Socio-demographic & Economic characteristics of respondents

Variable	Frequency (N=301)	Percent (%)
Religion		
Christianity	273	90.7
Islam	17	5.6
Traditionalist	9	3.0
No religion	2	0.7
Educational status		
Tertiary	4	1.3
SHS/Vocational Training	7	2.3
JHS	53	17.6
Primary	75	24.9
No education	162	53.8
Ethnicity		
Dagaaba/Wale	293	97.3
Fulani	8	2.7
Occupation (Source of income)		
Agriculture Worker	223	74.1
Civil Servant	3	1.0
Teacher	1	0.3
Health worker	1	0.3
Trader/Vendor	39	13
Number of ANC visits		
<4visits	22	7.3
4+ visits	279	92.7
Place of Delivery		
Home delivery	12	4.0
CHPS compound	31	10.3
Maternity Home	1	0.3
Health Centre	67	21.2
Hospital	190	63.1
Child's Age		
6-8months	60	19.9
9-11months	39	13.0
12-23months	202	67.1

Source: Author's Computation

Table 2: Socio-demographic & Economic characteristics of respondents

Variable		Frequency (N=301)	Percent (%)
Marital status			
	Single	3	1.0
	Married	287	95.3
	Widow	8	2.7
	Divorced	1	0.3
	Separated	2	0.7
Decision about food procurement/production			
	Mother	16	5.3
	Husband	182	60.5
	Mother and father	29	9.6
	Any other person	74	24.6

Age of Mother			
	Less than 18	10	3.3
	18-34	284	94.4
	34+	7	2.3
Number of children			
	1-2	278	92.4
	3+	23	7.6
Wealth Index			
	Low	179	59.5
	High	122	40.5
	Child weighed for past 4months		
	less than 4times	38	12.6
	At least 4times	263	87.4

Source: Author's Computation

4.2 Assessment of complementary feeding practices

The survey had majority (94%) of the respondents' initiating breastfeeding within 30minutes to one hour after delivery. Table (3 and 4) shows that 98.3% of the children received first yellowish milk (colostrum). At the time of the study, only 6.6% completely stopped breastfeeding. Reasons such as mother got pregnant (35%) or mother decided to wean child off from breastmilk (45%) constituted the majority. Child or mother was sick and child refused to suck were among the least reasons for stopping breastmilk. However, about 25% of the children stopped breastfeeding below 12months of age. With regard to those who were practicing breastfeeding, 47.7% of the respondents' breastfed less than six times within 24hours. Closely followed, 46.6% were breastfeeding their children between 6-8times a day. The rest 5.7% were able to breastfeed at least 9times within 24hrs. It was found that feeding before lactation was not common since 98.7% gave nothing. The proportion of the children 6-23months children who met adequate meal frequency was 52%. The analysis of the survey found that children who met the minimum dietary score were very low. The findings show that only 29% met the minimum dietary score. Again, results from the study shows 94.4% of the respondents have high level of knowledge on initiation of feeding practices. In addition, 85.7% received adequate messages on the initiation of complementary at six months. With respect to bottle feeding, 26% of the respondents admitted breastfeeding and feeding their children with feeding bottles. About 88% of the respondents timely introduced complementary feeding at six months. The study also found 3.3% of the respondents interrupted exclusive breastfeeding. Data indicated that, the practice of complementary feeding was very poor. The overall prevalence of appropriate complementary feeding practices in the municipality was 17%.

Table 3: Complementary feeding practices by respondents

Variable	Frequency (N=301)	Percent (%=100)
Appropriate complementary feeding		
Yes	50	17.0
No	251	83.0
Minimum Dietary score		
<4food groups	229	76.0
≥4food groups	72	24.0
Minimum Acceptable diet		
No	248	82.0
Yes	53	18.0
Minimum Meal frequency		
No	158	52.0
Yes	143	48.0
Bottle feeding		
No	222	74.0
Yes	79	26.0
Knowledge of starting complementary feeding		
Child less than six months	9	3.0
Child 6-12 months	284	94.4
Child 13-24months	3	1.0
Message on starting complementary feeding		
Yes	258	85.7
No	11	3.7
Can't remember	32	10.6
Currently eating any other food		
Yes	285	94.7
No	16	5.3
Introduction of solid or semi-solid food		
Yes	288	95.7
No	13	4.3
Timing of complementary feeding		
Late	36	12.0
Early	265	88.0

Source: Author's Computation

4.3 Prevalence of malnutrition

The Mean and standard deviation scores for the anthropometric indicators WHZ, WAZ and HAZ z-scores were −0.73 ± 1.13, −0.98 ± 1.06 and -0.88 ± 1.11respectively. Findings from the survey indicated in table 4.5 showed that, prevalence of malnutrition stood at 11.3% (95% CI 8.0–15.1) for wasting 14% (95% CI 10.0–18.1) for stunting and 18.6% (95% CI 14.0–22.9) for underweight respectively.

Table 4: Prevalence of Malnutrition in Children 6-12 month

Malnutrition related index		Frequency (N)	Percent (%)
Wasting	Severely Wasted	7	2.7
	Moderately Wasted	26	8.6
	Normal	267	88.7
	Total	**301**	**100.0**
Stunting	Severely stunted	6	2.0
	Moderately stunted	36	12.0
	Normal	259	86.0
	Total	**301**	**100.0**
Underweight	severely underweight	9	3.0
	Moderately underweight	47	15.6
	Normal	245	81.4
	Total	**301**	**100.0**
Mother BMI	Wasted	32	10.6
	Normal	238	79.1
	Overweight	22	7.3
	Obesity	9	3.0
	Total	**301**	**100.0**
Mother height	<150cm	14	4.7
	>150cm	287	95.3
	Total	**301**	**100.0**
MUAC	Severely wasted	5	1.7
	Moderately Wasted	33	11.0
	Normal	263	87.4
	Total	**301**	**100.0**

MUAC* Mid Upper Arm Circumference, BMI* Body Mass Index

4.4 Factors associated with inappropriate complementary feeding and WASH practices

The bivariate analysis results put in Table (5 and 6) shows that wealth index (t-test: X^2 =4.513, *P*=0.034) and taking decision on household food management (Fisher test (3, 301), *P*=0.007) were associated with appropriate complementary feeding. Table 4.14 indicates that source of households' income (Fisher test (2, 301), *P=0.005*), taking decisions on household ownership and management of WASH facilities (Fisher test (3, 301), *P*=0.007, number of children less than 5years in household (Fisher test (1, 301), *P*=0.007) and number of ANC visits during pregnancy (Fisher test (1, 301), *P*=0.011, mothers' educational level were found to be associated with households' WASH status. Also, respondents' knowledge on WASH was associated with WASH status. However, relationships that proved statistical significant (p<0.005) were tried in the multiple logistics regression to identify the predictors of both inappropriate complementary feeding and poor WASH practices. Additionally, both household wealth index and person's responsible for taking household decisions about food procurement and management were factors of inappropriate complementary feeding. Results further showed that, low educational status, number of children less than five years in the households, number of visits respondents' made during ANC and person's responsible for taking household decisions about WASH practices were determinants of poor WASH in the municipality.

Table 5: Background characteristics and appropriate complementary feeding

Variable		Appropriate complementary feeding N (%)		T-statistics
		No	**Yes**	
Religion				Fisher test (3,301), p=0.517
	Christianity	226 (90.0)	47 (94.0)	
	Islam	14(5.6)	3(6.0)	
	ATR	9(3.6)	0(0.0)	
	No religion	2(0.8)	0(0.0)	
Marital Status				Fisher test (1,301), p=0.710
	Single	11 (4.4%)	3(6%)	
	Married	240(95.6%)	47(94%)	
Source of Income				Fisher test (2,301), p=0.910
	Agric worker	185(73.7)	38(22.0)	
	Salary Worker	4(1.6)	1(2.0)	
	Service workers	62(24.7)	11(76.0)	
Place of delivery				X^2(2,301)=2.587,p=0.274
	Home	8(3.2)	4(8.0)	

	Level B facility	80(33.5)	15(32.0).3	
	Hospital	159(63.3)	31(60.0)	
Maternal Age				Fisher Test (2,301), p=1.000
	Less than 18years	9(3.6)	1(2.0)	
	18-34years	236(94)	48(96.0)	
	34+ years	6(2.4)	1(2.0)	
Wealth Index				$X^2(1,301)=4.513$, $p=0.0034$
	Low	156(62.2)	23(46.0)	
	High	95(37.8)	27(54.0)	
Making Household Decisions about food				Fisher test (3, 301), $p=0.007$
	Mother/caregiver	13(5.2)	3(6.0)	
	Husband/Partner	161(64.1)	21(42.0)	
	Mother and father	19(7.6)	10(20.0)	
	Any other person	58(23.1)	16(32.0)	

Source: Author's Computation

Table 6: Backgrounds and appropriate complementary feeding

Variable		Appropriate complementary feeding N (%)		T-statistic
		No	Yes	
Knowledge of starting complementary feeding				Fisher test (1,301),$p=0.324$
	No	16(6.4)	1(2.0)	
	Yes	235(93.6)	49(98.0)	
Received message of complementary feeding				Fisher Test (1,301),$p=0.077$
	Yes	211(84.1)	47(94.0)	
	No	40(4.0)	3(2.0)	
Household food security				$X^2(1,301)=0.065$,$p=0.799$
	No	61(24.3)	13(26.0)	
	Yes	190(75.7)	37(74.0)	
Number ANC Visits				Fisher test (1,301), $p=1.000$
	<4visits	19(7.6)	3(6.0)	
	At least 4 visits	232(92.4)	47(94.0)	
Number of children				Fisher test (1,301), $p=0.391$
	At most 2	230(91.6	48(96.0)	
	At least 3	21(8.4)	2(4.0)	
Ethnicity				Fisher test (1,301),$p=0.747$
		245(93.6)	48(96.0)	
	Others	6(6.4)	2(4.0)	
Education				Fisher test (2,301), $p=0.063$
	High	142(56.6)	1(2.0)	
	Low	99(39.4)	29(58.0)	
	None	142(56.6)	20(40.0)	

Source: Author's Computation

4.5 Complementary feeding practices, WASH practices and acute nutritional status of children 6-23months

Statically, Fisher-test (1, 301), p=0.025 from Table 7 showed that inappropriate complementary feeding was associated with the prevalence of wasting among the children of the respondents. Also, the timing of complementary feeding at six months and minimum meal frequency were found to be associated with the prevalence of wasting with p-values<0.001 respectively. In addition, table 8 indicates that households' wealth index has been clearly shown to be associated with wasting. Taking decisions about households' food procurement, production and management was also associated with the prevalence of wasting as stated in table 19. However, none of the WASH practices was associated with wasting in the study area.

Table 7: Complementary feeding practices and wasting in children 6-23months

	Classification of Acute malnutrition N (%)		
Variable	**Wasted**	**Normal**	**Test Statistics**
Appropriate complementary feeding			Fisher test (1, 301) p=0.025
No	33(97.1)	218(81.6)	
Yes	1(2.9)	49(18.4)	
Minimum Dietary Diversity			X^2 (1, 301)=0.003, p=0.955
No	26(75.0)	203(76.0)	
Yes	8(25.0)	64(24.0)	
Timing of complementary feeding at 6months			X^2 (1, 301)=52.674, p<0.001
No	17(75.0)	19(7.1)	
Yes	17(25.0)	248(92.9)	
Minimum meal frequency			X^2 (1, 301)= 16.538, p<0.001
No	29(87.5)	129(48.3)	
Yes	5(12.5)	138(51.7)	

Minimum acceptable diet				Fisher test (1, 301), p=0.058
	No	32(94.1)	216(80.9)	
	Yes	2(5.9)	52(19.1)	
Bottle feeding				X^2 (1, 301)=0.198, p=0.656
	No	24(70.6)	198(74.2)	
	Yes	10(29.4)	69(25.8)	
Knowledge on timing of complementary feeding				Fisher test(1, 301), p=0.421
	No	3(8.8)	14(5.2)	
	Yes	31(91.2)	253(94.8)	
Received message on complementary feeding practices				Fisher test (1, 301), p=0.799
	No	4(11.8)	39(14.6)	
	Yes	30(89.2)	228(85.4)	

Table 8: Water, Hygiene and Sanitation related prevalence of wasting of children 6-23months

Variable		**Classification of acute malnutrition N (%)**		**T-statistic**		
		Wasted	**Normal**	**Df**	**X2**	**P-value**
Latrine availability				1	1.484	0.223
	No	27(79.4)	185(69.3)			
	Yes	7(20.6)	82(30.7)			
Score on Hygiene and sanitation practices				1	0.000	0.997
	Poor	21(61.8)	165(61..8)			
	Good	13(38.2)	102(38.2)			
Frequency hand washing				1	0..218	0.640
	<3times	16(47.1)	137(51.3)			
	3+times	18(52.9)	130(48.7)			
Score Knowledge on WASH practices				1	0.062	0.804
	Low	13(38.2)	108(40.8)			
	High	21(61.8)	159(59.6)			
Score for WASH Status				1	0.200	0.888
	Poor	22(64.7)	176(65.9)			
	Good	12(35.3)	91(34.1)			
Kinds of latrine				1	1.283	0.257
	Bad	6(85.7)	53(64.6)			
	Good	1(14.3)	29(35.4)			
Source of Water				1	0.130	0.719
	Improved	3(8.8)	19(7.1)			
	Unimproved	31(91.2)	248(92.9)			
Diarrhea	No	21(61.8)	182(68.2)	1	0.563	0.453
	Yes	13(38.2)	85(31.8)			
Pneumonia	No	24(70.6)	201(75.3)	1	0.352	0.553
	Yes	10(29.4)	66(24.7)			
Malaria	No	13(38.2)	103(38.6)	1	0.001	0.969
	Yes	21(61.8)	164(61.4)			
Household food security				1	0.330	0.566
	Yes	7(20.6)	67(25.1)			
	No	27(79.4)	200(74.9)			

Source: Author's Computation

4.6 Complementary feeding practices, WASH practices and Stunting in Children 6-12months

Findings from the bivariate analysis of the survey clearly shows that the following variables were associated with stunting. Results from table (9 and 10) revealed that the following were associated with stunting. A statistically significant of 0.006 clearly shows that respondents practicing inappropriate complementary feeding was associated with stunting. Other infant and child feeding indicators like timing introduction of complementary feeding F (1, 301), x^2=1.721, p=0.001, children who met the meal frequency F (1,301), x^2=8.895, p=0.003, minimum acceptable diet Fisher test (1,301), p=0.016 were also associated with chronic malnutrition status of the children in the municipality at the time of the study. In addition, there were some socio-demographic and economic characteristics which were associated with stunting. Analysis from table 4.23 stipulated that, sources of income by respondents and the households' wealth index were linked with children chronic malnutrition status with the corresponding's statistically significant values of 0.013 and p<0.001 respectively. Furthermore, prevalence of wasting X^2 [(1, 301) = 5.002, p=0.025], age of child [Fisher test (1, 301) =7.184, p=0.020] and source of drinking water X^2 [(1, 301) =6.309, p=0.012], were significantly associated with stunting.

Table 9: WASH practices and stunting of children 6-23months

Variable		Classification of Chronic malnutrition N (%)		T-statistics
		Stunted	Normal	
Treatment of drinking water				Fisher test (1, 301),p=0.063
	No	36(90.0)	249(96.9)	
	Yes	4(10.0)	8(3.1)	
Score for Knowledge on WASH				X^2(1, 301)=0.294,p=0.588
	Low	20(47.6)	135(52.1)	
	High	22(52.4)	124(47.9)	
Score for Hygiene and sanitation practices				X^2(1, 301)=0.491,p=0.488
	Poor	28(66.7)	158(61)	
	Good	14(33.3)	101(39)	
Score for WASH Status				X^2(1, 301)=0.408,p=0.523
	Poor	27(64.3)	153(59.1)	
	Good	15(35.7)	106(40.9)	
Source of Water				X^2(1, 301)=6.309, p=0.012
	Improved	35(83.3)	244(94.2)	
	Unimproved	7(16.7)	15(5.8)	
Storage of drinking water				Fisher test (1, 301),p=0.095
	Bad	2(4.8)	2(0.8)	
	Good	40(95.2)	257(99.2)	
Diarrhea for past two weeks				X2(1, 301)=0.0013,p=0.908
	No	28(66.7)	175(67.6)	
	Yes	14(33.3)	84(32.4)	
Pneumonia for past two weeks				X2(1, 301)=0.054,p=0.817
	No	32(76.2)	193(74.5)	
	Yes	10(23.8)	66(25.5)	
Malaria for past two weeks				X2(1, 301)=0.558,p=0.0.445
	No	14(33.3)	102(39.4)	
	Yes	28(66.7)	157(60.6)	
Household food security				X2(1, 301)=0.016,p=0.900
	No	32(76.2)	195(75.3)	
	Yes	10(23.8)	64(24.7)	

Source: Author's Computation

Table 10: Complementary feeding practices and stunting of children 6-23months

		Classification of chronic malnutrition N (%)		Test statistics
Variable		**Stunted**	**Normal**	
Appropriate complementary feeding				Fisher (1, 301), p=0.006
	No	41(97.6)	210(81.1)	
	Yes	1(2.4)	49(18.9)	
Minimum Dietary Diversity				X2(1, 301)=0.637,p=0.425
	No	35(81.0)	195(75.3)	
	Yes	11(19.0)	132(24.7)	
Timing of complementary feeding at 6months				
	No	12(28.8)	24(9.3)	X2(1, 301)=12.721, p=0.001
	Yes	17(71.2)	248(90.7)	
Minimum meal frequency				X2(1, 301)=8.895, p=0.003
	No	31(73.8)	127(49)	
	Yes	30(26.2)	235(51)	
Minimum acceptable diet				Fisher Test(1, 301), p=0.016
	No	40(95.2)	208(80.3)	
	Yes	2(4.8)	51(19.7)	
Bottle feeding				X2(1, 301)=0.001, p=0.993
	No	31(73.8)	191(73.7)	
	Yes	11(26.2)	68(26.3)	
Knowledge on timing of complementary feeding				X2(1, 301)=0.205, p=0.651
	No	3(7.1)	14(5.4)	
	Yes	39(92.9)	245(94.6)	
Received message on complementary feeding practices				Fisher Test (1, 301), p=0.477
	No	4(9.5)	39(15.1)	
	Yes	39(90.5)	220(84.9)	

Source: Author's Computation

4.7 Inappropriate complementary feeding practices and poor WASH practices on Nutritional status of a child

The analysis of the logistic regression revealed Wealth index, inappropriate complementary feeding practices and age of child were significantly associated with stunting. Comparatively, in table 4.26, children of respondents' engaged in inappropriate complementary feeding practices were 8.1 times more likely [AOR 8.09; 95 %CI (1.06 – 60.70)] to suffer from stunting. It was found that children from households with low wealth index were also 8.4 times more likely [AOR 8.37; 95 % CI (2.85 – 24.59)] of being stunted. In addition, children within age category of 9-11monthswere 7.7times more chance (AOR = 7.72, CI = 1.83 – 32.59, P = 0.005) of suffering from chronic malnutrition. Also, children within age category of 12-23months were 3.9times more likely (AOR = 3.91, CI = 1.12 – 13.63, P = 0.032) of being stunted as compared to children 6-8months. Notwithstanding, the proportions of the variability in stunting explained by the two model is quite small. Therefore, it is noteworthy that the total amount of residual not accounted for by the relative contributory inappropriate feeding and poor WASH practices is quite large signifying that chronic malnutrition is explained by a good of number of other variables not found in the equation. The set of variables in the model found in the equation contributed to only 22.6% of the variance in stunting.

Table 11: Contribution of inappropriate complementary feeding practices and poor WASH practices to Stunting in Children 6-12 months

Covariates		Wald	Df	Sig.	Exp(B)	95% C.I. for EXP(B)	
						Lower	Upper
Age of child		7.744	2	0.021			
	9-11months	7.743	1	0.005	7.723	1.830	32.592
	12-23months	4.590	1	0.032	3.912	1.123	13.627
	6-8months	Reference					
In appropriate complementary feeding							
	Yes	4.069	1	0.044	8.091	1.061	61.700
	No	Reference					
Wealth Index							
	Low	14.936	1	0.000	8.370	2.849	24.585
	High	Reference					

Nagelkerke R= 22.6%, *Omnibus Chi sq. = 40.353, * Hosmer and Lemoshow test 99.3%

4.8 Inappropriate complementary feeding practices and poor WASH practices to Wasting

Households' Wealth index was statistically strong predictor of wasting from the analysis of the logistic regression. In table 4.27, children from low households wealth index were 4.2 times more likely [AOR 4.17; 95 % CI (21.56–11.17)] of being wasted. The set of variables found in the equation accounted for only 11.2% of the variability (Nagelkerke R Square = 0.112) in acute malnutrition.

Table 12: Inappropriate complementary feeding practices and poor WASH practices to acute malnutrition

		Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
						Lower	Upper
Wealth Index							
	Low	8.089	1	.004	4.173	1.559	11.169
	High	Reference					
Inappropriate complementary feeding							
	Yes	3.192	1	.074	6.326	0.836	47.865
	No	Reference					

*Nagelkerke R= 11.2%, *Model Chisq= 15.537, * Hosmer and Lemoshow test 85.8%

From table 11, households' Wealth index, minimum meal frequency, timing of complementary feeding were statistically strong predictors of wasting from the analysis of the logistic regression. In table 4.27, children who began complementary feeding late were 3.4 times more likely [AOR 3.44; 95 % CI (1.10 – 10.74)] of being wasted. The analyses also showed that, late timing of complementary feeding in children increases risk about 8.6 times more likely [AOR 8.56; 95% CI (3.61 – 20.64)] of becoming wasted. Lastly, children from low households' wealth index were 3.3 times more likely [AOR 3.3; 95 % CI (1.15–9.31)] to suffer acute malnutrition.

The set of variables found in the equation accounted for only 30.8% of the variability (Nagelkerke R Square = 0.308) in acute malnutrition. Additionally, from table 12, it clearly shows, inappropriate complementary feeding practices made a lot of significant contribution to the prevalence of stunting in the municipality relative to WASH practices and other determinants. Relative to other determinants, children of respondents who practice inappropriate optimal feeding practices were 8times more likely to suffer chronic malnutrition. The set variables in model 1 explained only 18.7% variability in stunting while the set of variables in model 2 accounts for only 22.7% variability in stunting.

Table 13: Inappropriate complementary feeding practices and poor WASH practices to acute malnutrition

		Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
						Lower	Upper
Wealth Index							
	Low	4.964	1	0.026	3.277	1.154	9.309
	High	Reference			1.000		
Inappropriate complementary feeding							
	Yes	.090	1	0.764	1.413	.148	13.486
	No	Reference					
Minimum Meal frequency							
	No	4.542	1	0.033	3.444	1.104	10.738
	Yes	Reference			1.000		
Timing of complementary feeding							
	No	23.731	1	0.000	8.569	3.611	20.337
	Yes	Reference			1.000		

*Nagelkerke R= 30.8%, *Model Chisq= 51.071, * Hosmer and Lemoshow test 94.9%

5. Discussion

This survey sought to establish the relative contribution of inappropriate complementary feeding (timing of complementary feeding, minimum meal frequency, minimum dietary diversity, and minimum acceptable diet) and poor WASH practices (availability of latrine, source of drinking water and hygiene and sanitation practices like hand washing, defecation at home etc.) to child growth. Complementary feeding is one of the central pillars supporting healthy growth and development of children (Udoh & Amodu, 2016) [44]. Therefore, achieving appropriate complementary feeding of young children is a crucial milestone in efforts to enhance survival and promote healthier growth and development of children (Menon, 2012) [31]. Most mothers (94%) initiated breastfeeding within 30minutes to one hour after delivery while 98.3% of the children received first yellowish milk (colostrums). Prevalence of prelateal feeding was 1.3%. This trend was also found in the health sector-wide regional annual reports 2016 (GHS, 2016). This similarity indicates effective of nutrition education and counseling during antental care and child welfare clinics. Evidence available suggests that feeding a baby solid foods earlier than 6 months may increase the risk of choking, gastric discomfort, food allergies, and becoming overweight or obese later in life is real (Udoh & Amodu, 2016) [44]. Also, starting solid foods after 9 months or waiting too long to start solid foods can result in a child who is resistant to trying solid foods, and may have difficulty of chewing (Udoh & Amodu, 2016) [44]. The findings of the study showed that 88% of the respondents timely introduced complementary feeding to their children 6-8months. The study also found 3.3% of the respondents having interrupted exclusive breastfeeding due to early initiation of solid/semi-solid feeds. Similarly, this high prevalence was found in a study in Sodo town, Southern Ethiopia, where 94.6% mothers timely initiated complementary foods at 6-8months (Tefera *et al*., 2017) [42]. That study equally discovered3.3%of the mothers starting complementary food before six months. Similarly, prevalence of 85.4% was found for the timely initiation of complementary feeding among infants aged 6–8 months at Akpabuyo Area, Cross River State Nigeria in a study (Udoh & Amodu, 2016) [44].

More importantly, the Ghana Demographic and Health survey in 2014 revealed a relatively better, 73% prevalence of timing introduction of complementary foods at six months within children aged 6-8months (GDHS, 2014). The Ghana multiple Indicator Cluster Survey (GMCS) also reported 75% timely initiation. Therefore, the high prevalence of gaining complementary foods at 6–8 months in the current study is motivating; however, it is still a worrisome situation with the percentage still engaged in inappropriate introduction. There is still this wrong perception of mothers that feeding breast milk alone may not meet the child's requirement hence poor initiation or some mothers perceived that they were not producing enough milk. Also, child refusal to eat solid/semi solid food was attributed to some of the mothers imitating late food. Moreover, the infant and young child feeding interventions currently implemented together with effective antenatal care contributed to the high rate since most of the respondents had high knowledge and received adequate messages as when to begin complementary feeding after birth. The findings of the study showed that just about half (52%) of the children 6-23months met the minimum number of meal frequency for the past 24hours at the time of the study. A similar trend was reported in a study in Northwest Ethiopia where the proportion of children who received adequate minimum meal frequency was 50.4 %(Beyene *et al*., 2015) [6]. Likewise, the Ghana Multiple Indicator Cluster Survey (GMICS) 2011 found that more than half (57%) of the children aged 6-23 months received complementary foods the minimum number of times. However, the Ghana Demographic and Health survey reported that only 37% and 45% of children aged 6-23 months received solid/semi-solid food the minimum number of times for non-breastfed and breastfed children respectively (GDHS, 2014). Indeed, the results of the current study depict an improvement.

The results of the survey indicate that children who met the minimum dietary diversity score were very low. Only 29% and 18% of the children among the study population received the minimum dietary diversity and minimum acceptable diet in the study area respectively.In a study involving similar age category (6–23 months) of children in Woliata Sodo town, the rate of minimum dietary diversity was 27.3% relatively apparent to the results reported by the current study (Mekonnen *et al*. 2017) [29]. Majority of the respondents were housewives and therefore engaged in agricultural works. This could explain the similarities in the diversity score in both study. In a similar terrain, the rate of children meeting the minimum dietary diversity was 28.5% similar to the finding of the current study (Tegegne *et al*., 2017) [43]. Also, in another study, prevalence of minimum dietary diversity and minimum meal frequency were 31.5% and 36.7% respectively. However, the rate of meeting minimum acceptable diet was only 7.3% (Udoh & Amodu,

2016) [44]. In 2014, 15% of the breastfed children 6-23months met the minimum criteria for the child feeding practices with regards to food diversity and meal frequency (GDHS, 2014). The current study demonstrated a greater improvement of both feeding practices and this could be due to the rise in the level awareness and practice of the inherent breastfeeding among mothers. About 93.4% of the mothers practice breastfeeding from the recent survey while 52.3% frequently breastfed their children at least 6times daily. Again, effective implementation of IYCF interventions and mothers education during child welfare clinics (CWC) and antenatal clinics (ANC) could contribute to this high prevalence. In contrast, some studies recorded very low prevalence of 10.6% and 12.6% of children receiving the recommended minimum dietary diversity of at least the 4food groups within 24hours (Dangura & Gebremedhin, 2017, Beyene *et al*., 2015) [9, 6]. In fact, most of the findings clearly outlined the challenge with nutrition education and compliance with IYCF practices the major hindrances to the low prevalence of the feeding practices indicators.

In this study, appropriate complementary feeding was a composite indicator of timely introduction of complementary food, minimum dietary diversity and minimum meal frequency. A child was said to have received appropriate complementary feeding if he/she attained above the mean score of the three IYCF indicators in the past 24 hours prior to the study and whether complementary foods were initiated at six months. Sub-optimal feeding practice was highly prevalence due to lack of compliance to any of the recommended feeding practices. Averagely, the overall score of mothers who were practicing appropriate complementary feeding was 17%. Similarly, only 14.3 % of appropriate complementary feeding practices was recorded in a study (Saaka *et al*., 2016) [37]. More so, another study found only 15.7% of the study population who attained appropriate complementary feeding (Saaka, *et al*., 2015) [38]. Far below the findings of the study, a survey in some parts of Southern Ethiopiafound 9.5% of mothers of the study population practicing appropriate complementary feeding (Kassa *et al*, 2016) [21]. Generally, the world is confronted with poor dietary quality of the foods often served to children 6-23months (Abeshu, 2016). The foods of the children aged 6–23 months are often characterized by too little variety; inappropriate consistency of food, deficient in micronutrients such as vitamin A, iron, zinc, and calcium; too little essential fatty acids; and too less dense calories among non-breastfed infants(Abeshu, 2016). Poor WASH practices and child under nutrition coexist in many developing countries (Black *et al*. 2013) [8]. The growing evidence available indicates that poor WASH conditions, specifically exposure to poor sanitation is linked with childhood stunting (Dodos *et al*., 2017) [11]. Access to proper sanitation facilities like toilets may reduce the menace of open defecation which will translate into the growth of a child since consuming safe food will be adequately absorbed and utilized (Okullo *et al*, 2017) [35]. Under the current study, poor or good WASH is defined by meeting the criteria of having access to sanitary facilities like latrines, access to quality water and hygiene and sanitations practices of the respondents and child. The findings of the study revealed WASH practices of the municipality were poor. Little above average (59.2%) of the respondents was found to be practicing poor WASH. The coverage of owning households latrine was 29.6% at the time of the study with majority (56.2%) of the household latrines being open pit latrines without slabs. Indeed, the 2010 housing and population census confirms such situation where, majority of households (81.0%) does not have toilet facilities in their homes and therefore resort to open defecation in the Municipality (GSS, 2014).More than 1 in 4 (26%) of households use a unimproved toilet facility in Ghana (GDHS, 2014). In support of the findings of the current study, about 55.2% and 40.2% attributed lack of latrines to no money for latrine construction and availability of vast land or area such as open fields/forests/water bodies for open defecation respectively. Also, about 92.7% of the households have access to improve water source with majority depending on borehole. This was also reported by the multiple indicator cluster survey 2011 in Ghana. It indicates that the population having access to the following types of improved sources of drinking water; piped water, tube well/borehole, protected well, protected spring, and rainwater collection nearly 80%. The population and Housing census of 2010 brought forward that about 91% of the population in urban areas have access to improved water while 69% for the population in rural areas in Ghana (GSS, 2011) [18]. Meanwhile, 10% of households in Ghana still rely on unimproved water sources (GDHS, 2014). On hygiene and sanitation, the average hygienic practices score by respondents was poor since 61.8% were engaged in bad hygienic and poor sanitation practices. Specifically on the practice of sanitation, the rate of open defecation among households was71.1%.The MICS in 2011 reported that about 58.5% of households in Ghana were engaged in similar practices especially with regards to children feaces (GMCS, 2011). Similarly, in the 2010 census reports, most households in Ghana indiscriminately dump their solid waste. Thus, approximately 1 out of 4 households (23%) practice open defecation (GSS, 2011) [18].

Contrary to other studies, about 97.3% of the respondents were practicing hand washing as well as 72.8% were also washing their children hands as reported by the study. Furthermore, 50.8% of the mothers were practicing handwashing at most 3times daily and 74.4% of the households had designated/fixed places for hand washing. Households with designated places for hand washing had 50% availability both water and soap. In view of the above findings of the hygienic practices, MICS 2011 established that, only 24% of the households in Ghana have specific place for hand washing while 70%of the households could not designate a specific place where household members habitually wash their hands (GSS, 2011) [18]. The current community led total sanitation intervention implemented by Ghana Health Service in partnership with UNICEF could account for the gaps in the findings. The bivariate analysis showed that respondents from households with low wealth index (P=0.034) was associated with inappropriate complementary feeding practices. Also, taking decision on household food management (P=0.007) was associated with appropriate complementary feeding. The multiple logistic regression analysis still revealed that decision making on household food issues low wealth index were strong predictors of the inappropriate complementary feeding practices in the municipality. This is in line with the findings made by the following studies (Molla *et al*., 2017) [33] (Khan *et al*., 2017) [22] (Beyene *et al*., 2015) [6]. Again, the bivariate analysis indicates that source of households' income ($P=0.005$), taking decisions on household ownership and

management of WASH facilities (*P*=0.007), number of children less than 5years in household (*P*=0.007) and number of ANC visits during pregnancy (*P*=0.011), mothers' educational level were found to be associated with households' WASH status. Also, respondents' knowledge on WASH was associated with WASH status. However, the multiple logistic regression analysis showed that educational status, number of children less than five years in the households, number of visits respondents' made during ANC, and person's responsible for taking household decisions about WASH practices were determinants of Poor WASH practices. Similar findings was reported in Ethiopia (Wondimu, 2016) [45]. Also, in a related study, safe stool disposal phenomenon is associated with mother's education and wealth index quintile (GSS, 2011) [18]. Prevalence of malnutrition of the Municipality stood at 11.3% (95% CI 8.0–15.1) for wasting 14% (95% CI 10.0–18.1) for stunting and 18.6% (95% CI 14.0–22.9) for underweight respectively.In lieu of the current study, a study conducted on returnee children 6-23 months of age in northern Uganda found wasting rate of 11.1% and underweight of 22.7% (Mokori *et al*., 2013) [32]. Also, 10.8 percent of the children found moderately wasted and only 1 child was found to be severely wasted in a study. Among the study population, the following nutritional status were recorded 20.5 %, 11.5 % and 21.1 % being stunted, wasted and underweight respectively (Saaka *et al*., 2015) [38]. In addition, a study conducted in Northern Ghana revealed that the levels of stunting, underweight and wasting were 27.2, 17.6 and 8.2 % respectively (Glover-amengor *et al*, 2016) [17]. This was also recorded in a study conducted in Amhara National Regional State, Northwest Ethiopia on the levels of stunting, wasting, and underweight were 24.9%, 11.1%, and 14.3%, respectively (Amare *et al*, 2016) [5]. However, Upper west region recorded 22.2% prevalence of stunting as well as 13.5% prevalence of underweight (GDHS, 2014). Indeed, the region also recorded 4.4% wasting rate with 1.4% been severely wasted. The variation of these results with the current study may be the results of the high prevalence of wasting among the children or else the rate of stunting as compared to the regional prevalence and others would have suggested a greater improvement. In fact, the high prevalence of wasting also has a consequential effect of contributing to child mortality.

Prevalence wasting of 11.1% was found among household with unhygienic latrines as compared to 3.3 % among households with hygienic latrines. The study also found 13.6% prevalence of wasting among households with unimproved water sources as compared to 10.9% of wasting among households with improved water source. In a study that examines childhood malnutrition and its associated factors in some low and middle income countries put out that the utilization of pit latrine and flush toilets have significantly progressive effect on child acute malnutrition (Smith *et al*, 2005) [40] which can also be linked to reduced rate of gastrointestinal infections (Lin *et al*., 2013) [26]. Also, the study recorded 18.6% of stunting prevalence among household with unhygienic latrines as compared to 6.7% among households with hygienic latrines. Comparatively, the study a recorded a higher prevalence of 31.8% of stunting among households with unimproved water sources than 12.5% prevalence among households with improved water source. Further analysis revealed that children in households with unimproved source of drinking water recorded higher odds of stunting (Wondimu, 2016) [45]. The prevalence of stunting among children 6-23months ranged from 25% to 50% across the three surveys. In this evidence comparing with open defecation, households that have access to toilet facilities were associated with 16–39% decreased odds of stunting among the study population (Rah *et al*., 2015). Categorically, inappropriate complementary feeding was found to be associated with the prevalence of both wasting (*p=0.025*) and underweight *(p<0.001)* among the children 6-23months of age in the study area. It was equally associated with stunting ((*p=0.006*) among the study population. A study in Myanmar has demonstrated that an inappropriate feeding practice was one of the relevant causes of malnutrition (Zhao *et al*., 2016) [46]. Similarly this was also reported in Mbagathi district hospital-Kenya (Zhao *et al*., 2016) [46]. More specifically, timing of complementary feeding at six months and minimum meal frequency were found to be associated with the prevalence of wasting with *p<0.001* respectively. Other infant and child feeding indicators like timing introduction of complementary feeding (*p=0.001*) children who did not meet the meal frequency *(p=0.003)* minimum acceptable diet *(p=0.016)* were also associated with chronic malnutrition status of the children in the municipality at the time of the study. As a composite indicator, underweight had inappropriate timely introduction, minimum meal frequency and minimum acceptable diet with *P<0.001* being feeding practices associated with it. However, the study found that minimum dietary diversity was never associated with any childhood malnutrition. A study also reported a statistical significant association between compliance with WHO' guideline on timely introduction of complementary food, underweight and stunting, p = .001.However, the study found no relationship with wasting (Niayesh, 2018) [34].

Relating to the findings from the current study, a study in Cross state, Nigeria revealed that children with inappropriate timely complementary feeding was associated with wasting. Also, children who did not meet the minimum meal frequency was associated with stunting (Udoh & Amodu, 2016) [44]. In a similar terrain, an evidence pointed to the fact that inappropriate age of complementary feeding initiation, low dietary diversity score, and bottle feeding were identified significant predictors of childhood stunting (Fekadu *et al*., 2015) [13]. A similar study recorded a higher prevalence of under nutrition in infants whom complementary feeding was introduced before six months as well as those who complementary feeding was inadequate, or inappropriate (Sreedhara & Banapurmath, (2013) [41]. From a study in Northern Ghana, the analysis revealed inappropriate introduction of complementary feeding associated with chronic malnutrition. Also, there was significant positive association between appropriate complementary feeding wasting (Saaka *et al*., 2015) [38].

The bivariate analysis showed that inappropriate complementary feeding and households' wealth index were statistically significant to the prevalence of wasting among the children of the respondents. The Multiple logistic regression analysis in table 4.27 revealed that children from low households wealth index were 4.2 times more likely [AOR 4.17; 95 % CI (1.56–11.17)] of being wasted. Also, children who received inappropriate complementary feeding were 6.3times more likely [AOR 6.33; 95 % CI (0.84- – 47.87)] of being wasted. These findings were comparable with a study conducted in Nigeria (Udoh & Amodu, 2016)

[44]. The bivariate analysis revealed that inappropriate complementary feeding practices, sources of income of respondents, age of child, wasting, household's wealth index and source of household drinking water were statistical significantly associated with stunting. The Multiple logistic regression of associated determinants revealed that Wealth index, inappropriate complementary feeding practices and age of child contributed significantly to stunting. Similarly to this study, a study by UNIVERSA MEDICINA found that inappropriate complementary feeding practice was the most common factor for stunting (Hijra, *et al*. 2016) [20]. Statistically, children of respondents' who engaged in inappropriate complementary feeding practices were 8.1 times more likely [AOR 8.09; 95 % CI (1.06 – 60.70)] to suffer from stunting. In addition, it was found that children from households with low wealth index were also 8.4 times more likely [AOR 8.37; 95 % CI (2.85 – 24.59)] of being stunted. A study revealed that children from households with high wealth index were 51 % protected against stunting (Saaka *et al*., 2015) [38]. This is also comparable with study (Endris *et al*., 2017) [12]. Furthermore, children within age category of 9-11months were 7.7 times more chance (AOR = 7.72, CI = 1.83 – 32.59, *P* = 0.005) of suffering from chronic malnutrition. Also, children within age category of 12-23months were 3.9times more likely (AOR = 3.91, CI = 1.12 – 13.63, *P* = 0.032) of being stunted as compared to children 6-8months. This is in agreement with other studies (Endris *et al*., 2017; Habaasa, 2015; Udoh & Amodu, 2016) [12, 19, 44]. The variability in stunting is accounted for by only 3% of the interaction effects of inappropriate complementary feeding and poor WASH practices. The Beta coefficient of the modification effects clearly indicate that any rise in the prevalence of stunting has a less decreased risk association with complementary feeding practices as compared to more protection associated with the interaction effect and WASH practices. Also, the variability in wasting is also explained by only 8.5% of the interaction effects of inappropriate complementary feeding and poor WASH practices. However, the beta coefficient of the modification effect of WASH and complementary feeding practices on wasting indicates that any rise in wasting is being contributed by more as 8.7% by the interaction effect. It was reported in a study in Bangladesh that socio-economic status (SES) and WASH significantly affect wasting. However, SES and WASH were significantly interrelated. Therefore, WASH practices at least partially mediate the relationship between SES and wasting status of children (Raihan *et al*., 2017) [36].

6. Conclusion and recommendations

The following conclusion remarks were drawn from the study; the overall prevalence of appropriate complementary feeding practices in the municipality was 17.5%. Also, the Score for good WASH practices was 40.2%. The access to hygienic latrines, practices of good hygiene and sanitation were 29.6% and 38.2% collectively accounted for this abysmal performance. Also, complementary feeding and WASH practices among mothers of children aged 6-23monhs of the municipality were entirely inappropriate. The prevalence of wasting, stunting and underweight of 11.3%, 14% and 18.6% respectively, this clearly indicates that the burden of malnutrition in the municipality is still high. The immediate strong predictors of inappropriate complementary feeding practices in the area are: low household wealth index and wrongful person's responsible for taking household decisions. Likewise, low mothers' educational status, high number of children less than five years in the households, inadequate number of visits respondents' made during ANC and wrongful person responsible for taking household decisions about WASH practices are determinants of poor WASH in the municipality. Relatively, low wealth index, inappropriate complementary feeding practices and age of child contributed significantly to the prevalence of stunting. Also, low households' Wealth status statistically contributed to wasting in the municipality. The study recommended the Ghana Heath Service, policy makers, funding agencies and other health partners to be innovative and implement relevant interventions targeted at infant and young feeding and WASH practices to improve the nutritional status of children in the municipality.

7. References

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