
Prevalence of Edematous Malnutrition Among Under 5 Children Admitted to Hawassa University Comprehensive Specialized Hospital

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Abstract: Severe acute malnutrition is a disease that results from the chronic intake of a diet containing minimal to low levels of energy or protein with subsequent development of metabolic decompensation manifesting either in the form of an edematous or non-edematous clinical syndrome. As Ethiopia is one of the poorest countries in the world, the prevalence of undernutrition is one of the top ten causes of under-five mortality. Objective: To determine the prevalence of edematous malnutrition in under five children who had been admitted to Hawassa University comprehensive specialized hospital. Methodology: An institution-based cross-sectional study was conducted to assess the prevalence of edematous malnutrition in Under five children who had been admitted to Hawassa university comprehensive specialized hospital pediatrics and child health unit from September 11, 2018, to June 8, 2019. The list of all children who are 5yrs and below registered in Hawassa university referral Hospital, pediatrics, and child health ward in the study period was taken as a sampling frame and then an identification number was given to all sampling frames. The study subjects (patients' documents) were drawn by using systematic sampling. Results: Generally severe malnutrition in under five children affected around 49.3% of them. Among those children, a positive relationship was found between age and edema. As age increases, the risk of developing severe wasting decreases as is evident in our study, 47.7% of children are under 1 year of age and 32.3% are between 1 and 3 years of age while 20% are between 3 and 5 years which is decreasing in prevalence as age group increases. Conclusion: The proportion of severe malnutrition with severe wasting is more than that of edematous malnutrition. Edematous malnutrition peaks at between 1 and 3 years of age but severe wasting peaks in under one year of age children. Second, the prevalence of infection was higher among children with severe wasting.

Keywords: Edematous Malnutrition, Under-Five Children, Prevalence

1. Introduction

Malnutrition is the condition that results from eating a diet in which certain nutrients are lacking, in excess, or in the wrong proportions [6, 7]. Several different nutrition disorders may arise, depending on which nutrients are under or over-abundant in the diet; these include under-nutrition, obesity, overweight, and micronutrient deficiency. In most of the world, malnutrition is present in the form of undernutrition, which is caused by a diet lacking adequate calories and protein [8, 9], not enough food, and of poor quality. A growing trend of obesity is now a major public health concern in lower socio-economic levels and in developing countries as well [10].

Malnutrition is a leading cause of death among children younger than 5 years old contributing to one-third of the deaths in young children [1, 2]. Due to suitable cultural and economic reasons, it is more prevalent in developing countries [3]. The manifestations are marasmus, a non-edematous syndrome, or kwashiorkor, a syndrome characterized by bipedal edema [4]. The presence of edema indicates severe undernutrition [5]. Mortality rates were 34% and 22% for edematous and marasmic patients [4]. The World Health Organization has reported hunger and related malnutrition as the greatest single threat to the world's public health [11]. Improving nutrition is widely regarded as the most effective form of aid [11, 12]. Emergency measures include providing deficient micronutrients through fortified sachet powders or directly through supplements. [13, 14] WHO, UNICEF, and the UN World Food Program recommend community management of severe acute malnutrition with ready-to-use therapeutic foods, which have been shown to cause weight gain in emergency settings thus, knowing the prevalence of edematous malnutrition and associated risk factors for its development is of insuperable importance.

2. Methods

2.1. Study Area and Period

The study is conducted from September 11, 2018, to June 8, 2019, in HUCSH, which is found in newly structured Sidama regional state, Hawassa town. Hawassa is located 270 km southeast of the capital city of Ethiopia, Addis Ababa, with an estimated population of around 258,808. HUCSH is the first referral hospital established in the region serving as a teaching hospital for the College of Medicine and Health Science of Hawassa University, with a catchment population of 10-12 million. It serves about 43,384 patients of all types per year. HUCSH is providing post-graduate programs in Internal medicine, Surgery, Gynecology and obstetrics, Pediatrics, Pathology, and Ophthalmology.

2.2. Study Design, Study Population, and Sampling

An institution-based cross-sectional study was conducted

to assess the prevalence of edematous malnutrition in under five children in HUCSH using secondary data (patients' documents) from the pediatrics and child health unit, the patient charts were drawn by using systematic sampling. Because the source population (N) is less than 10,000 (500 under five pediatric patients were admitted in the study period) the sample size is adjusted using the adjustment formula.

$$nf = \frac{ni}{1+ni/N}$$

'nf' is an adjusted sample size;

'ni' is the calculated sample size;

'N' is the source population;

nf= 366/1+366/500;

nf= 211.32.

So, a total of 211 children were enrolled in this study. The collected data was cross-checked manually for its completeness and consistency and analyzed using SPSS window version 20.

2.3. Data Collection and Quality Control

After obtaining approval from the IRB of HUCSH checklist was prepared by the principal investigator for review of pertinent literature. Training is given for data collectors on data collection procedures and the completeness was checked by the principal investigator for any inconsistency and ambiguity. Finally, it was fed into the computer and analyzed and interpreted.

2.3.1. Data Analysis

The collected data is cleaned and manually entered into open Epi- version 3 and exported to SPSS version 20 statistical software for analysis. Descriptive analyses like frequency distribution, proportion, and dispersion were calculated. The finding is presented using frequency tables, graphs, and charts. Both univariate and multivariate analyses were done. A P value of ≤ 0.05 was considered statistically significant.

2.3.2. Operational Definition

Severe malnutrition - a child with pitting edema (swelling) of both feet; kwashiorkor or marasmic kwashiorkor, or severe wasting (<70% weight for height or <3 SD).

Acute respiratory illness - A child with cough and fast breathing or difficulty breathing.

Complementary foods - are foods that are required by a child, after six months of age in addition to sustained breastfeeding.

Diarrhea -a child with loose stools. Three or more times a day and signs of dehydration.

Fever -a child with elevated body temperature (>37.5°C) than usual.

Malnutrition -refers to undernutrition or deficiency in protein energy malnutrition.

Stunting -height for an age that is less than the international median NCHS/WHO reference value by more

than two standard deviations.

Severe wasting – Weight for height below -3SD or less than 70% of the median NCHS/WHO reference values.

Wasting – Weight for height less than the international median NCHS/WHO reference value by >2 SD.

Normal vital sign range (Blood pressure, Pulse rate, Respiratory rate) – Within +/- 2 SD.

Anemia –History of anemia: symptoms of anemia. Hematocrit or hemoglobin value below the range (< 12gm/dl).

3. Result

3.1. Socio-demographic Characteristics

Among the 211 children included in the study, most of them (49.5%) are below 12 months of age, 36% of them are between 12 and 36 months old, and the remaining 14.3% are between 36 and 60 months old. Sex-wise, 57.3% are males while 42.7% of them are females.

Among those 53.1% live in a rural area while the rest (46.9%) are urban residents. (Table 1)

Table 1. Socio-demographic characteristics of children 0-60 months old in Hawassa University Comprehensive Specialized Hospital admitted from September 11, 2018 - June 8, 2019, Hawassa, Ethiopia.

Characteristics	Frequency	Percent
Age (in months)		
0-12	105	49.7
13-36	76	36
37-60	30	14.3
Total	211	100
Sex		
Male	121	57.3
Female	90	42.7
Total	211	100
Address		
Rural	112	53.1
Urban	99	46.9
Total	211	100

3.2. Signs and Symptoms at Admission

Among the total of 211 cases, fever, cough, vomiting, and diarrhea are the most common presenting symptoms accounting for 71.1%, 61.1%, 60.7%, and 49.8% respectively (Table 2).

Table 2. Signs and symptoms at the admission of children 0-60 months old in Hawassa university referral hospital admitted from September 11, 2018 - June 8, 2019.

Characteristics	Frequency	Percent
Fever	150	71.1
Cough	129	61.1
Vomiting	128	60.7
Diarrhea	105	49.8
Shortness of breath	63	29.9
Edema	60	28.4
Anemia	56	26.5
Nausea	8	3.8
Neck stiffness	12	5.7
Loss of consciousness	8	3.8
Hepatomegaly	18	8.5
Splenomegaly	5	2.4
Peeling of skin	14	6.6
Night sweat	16	7.6
Weight loss	13	6.2
Abnormal body movement	13	6.2
Loss of appetite	20	9.5
Urinary compliant	9	4.3
Other symptoms	12	5.7

3.3. Dehydration Status at Admission

From the total of 211 records, 181 show no dehydration, 22 show some, and 8 of them show severe dehydration (Figure 1).

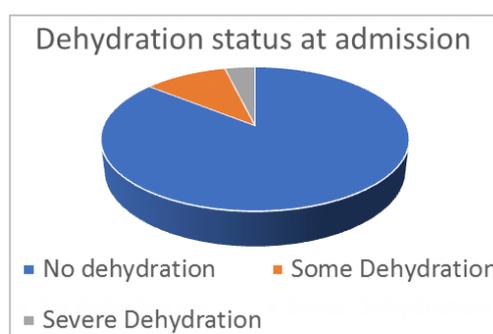


Figure 1. Dehydration status of children 0-60 months old in Hawassa university comprehensive specialized hospital admitted from September 11, 2018 - June 8, 2019.

3.4. Secondary Diagnosis at Admission

Among 211 patients, pneumonia, acute gastroenteritis, and pulmonary tuberculosis are the commonest secondary diagnosis at admission accounting for, 53.6%, 31.3%, and 19.4% respectively (Figure 2).

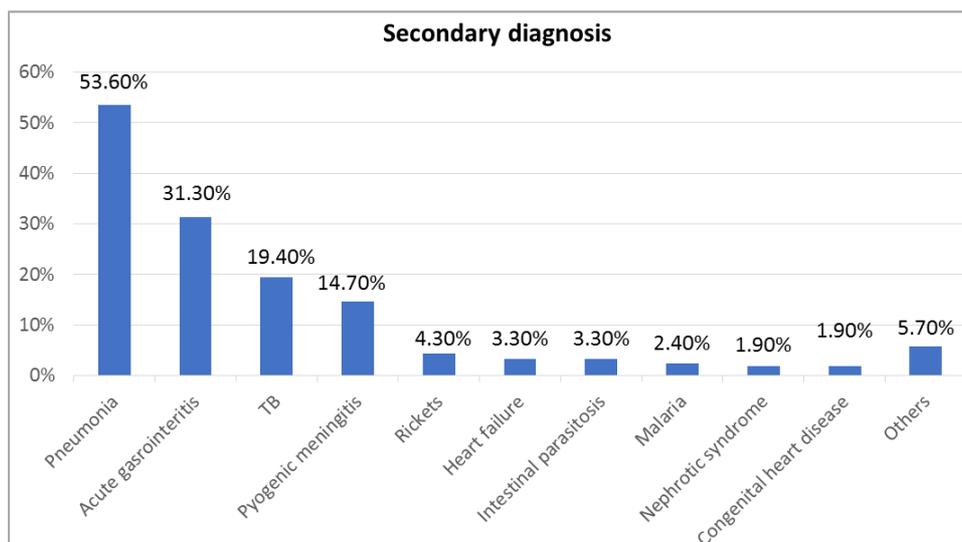


Figure 2. Secondary diagnoses of children 0-60 months old in Hawassa university referral hospital admitted from September 11, 2018 - June 8, 2019.

3.5. Feeding Practice

When we see the feeding practice, 3.3% were EBF for less than 6 months, 1% were formula fed, 35.1% were on complementary feeding, and a large proportion of those under 6 months of age are on EBF (10.4%) (Table 3).

Table 3. Feeding practice of children 0-60 months old in Hawassa university comprehensive and specialized hospital admitted from September 11, 2018 - June 8, 2019.

Characteristics	Frequency	Percent
Exclusively breastfed for less than 6 months	5	2.4
Formula-fed	1	0.5
Complementary feeding	166	78.7
Less than 6 months and on EBF	29	13.7
Less than 6 months and on mixed feeding	5	2.4
Less than 6 months and on replacement feeding	5	2.4

3.6. Pertinent Findings of Physical Examination

3.6.1. Vital Signs

Most of the children had vital signs within the normal range (Table 4).

Table 4. Vital signs of children 0-60 months old in Hawassa university comprehensive specialized hospital admitted from September 11, 2018 - June 8, 2019.

Characteristics (vital signs)	Above Range		Normal range		Below range		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Pulse rate	102	48.3	106	50.2	3	1.4	211	100.0
Respiratory rate	84	39.8	125	59.2	2	0.9	211	100.0
Temperature	55	26.1	150	71.1	6	2.8	211	100.0

3.6.2. Anthropometry

Among 211 patients 19.4% had normal weight for age while 15.6% of them had mild wasting. Moderate and severe wasting was shown among 25.6% and 39.3% of the children respectively (Table 5).

Table 5. Weight for the age of children 0-60 months old in Hawassa university comprehensive specialized hospital admitted from September 11, 2018 - June 8, 2019.

Weight for age	Frequency	Percent
Normal (>90%)	41	19.4
Mild wasting (75-90%)	33	15.6
Moderate wasting (60-74%)	54	25.6
Severe wasting <60%	83	39.3
Total	211	100.0

Among 211 patients, 30.8% had normal while 16.6% of them had mild stunting. Moderate and severe stunting was observed in 18.5% and 34.1% of patients respectively (Table 6).

Table 6. Height for the age of children 0-60 months old in Hawassa university comprehensive specialized hospital admitted from September 11, 2018 - June 8, 2019.

Height for age	Frequency	Percent
Normal >95%	65	30.8
Mild stunting 90-95%	35	16.6
Moderate stunting 85-90%	39	18.5
Severe stunting <85%	72	34.1
Total	211	100.0

Among 211 patients, 21.3% had normal while 18.5% of them had mild wasting. moderate and severe wasting was observed in 29.4% and 30.8% of patients respectively (Table 7).

Table 7. Weight for the height of children 0-60 months old in Hawassa university comprehensive specialized hospital admitted from September 11, 2018 - June 8, 2019.

Weight for height	Frequency	Percent
Normal >90%	45	21.3
Mild wasting 81-90%	39	18.5
Moderate wasting 70-80%	62	29.4
Severe wasting <70%	65	30.8
Total	211	100.0

The study indicates that 39.3% of the children had developed edema or severe wasting while 10% of them had both edema and severe wasting. Whereas 39.3% of them were presented with either edema or severe wasting while 10% of them had both but 50.7% had neither edema nor severe wasting (Table 8).

Table 8. Prevalence of severe malnutrition of children 0-60 months old in Hawassa university comprehensive specialized hospital admitted from September 11, 2018 - June 8, 2019.

	Frequency	Percent
Edema or Severe Wasting	83	39.3%
Both Edema and Severe wasting	21	10%
No Edema or Severe wasting	107	50.7%

3.7. Sero-Status for Retroviral Infection (RVI)

Among 211 of them, 1.9% of them were reactive for RVI, 46.4% were non-reactive & 51.7% of them have unknown serostatus (Table 9).

Table 9. Seroreactivity for RVI of children 0-60 months old in Hawassa university comprehensive specialized hospital admitted from September 11, 2018 - June 8, 2019.

Sero-status	Frequency	Percent
Reactive	4	1.9
Non-reactive	98	46.4
Unknown	109	51.7
Total	211	100.0

3.8. Immunization Status

Among 211 patients 48.8% are fully vaccinated while 16.6% of them are vaccinated appropriate for their age. Partially vaccinated and non-vaccinated were 8.5% and 9.5% patients respectively. We couldn't find a record of their vaccination

status for 16.6% of patients (Figure 3).

3.9. Investigation Results

On the CBC profile, most of the children had decreased RBC count and hematocrit while WBC increased in the majority of them (Table 10).

Table 10. CBC & ESR results of children 0-60 months old in Hawassa university comprehensive specialized hospital admitted from September 11, 2018 - June 8, 2019.

	Increased		Decreased		Normal		No record	
	Number	Percent	Number	Percent	Number	percent	number	Percent
RBC	4	1.9%	110	52.1%	77	36.5%	20	9.5%
WBC	111	52.6%	5	2.4%	77	36.5%	18	8.5%
Platelet count	61	28.9%	40	19%	89	42.2%	21	10%
Hemoglobin	4	1.9%	143	67.8%	46	21.8%	18	8.5%
Hematocrit	8	3.8%	93	44.1%	96	45.5%	14	6.6%
ESR	34	16.1%	22	10.4%	19	9.0%	136	64.5%

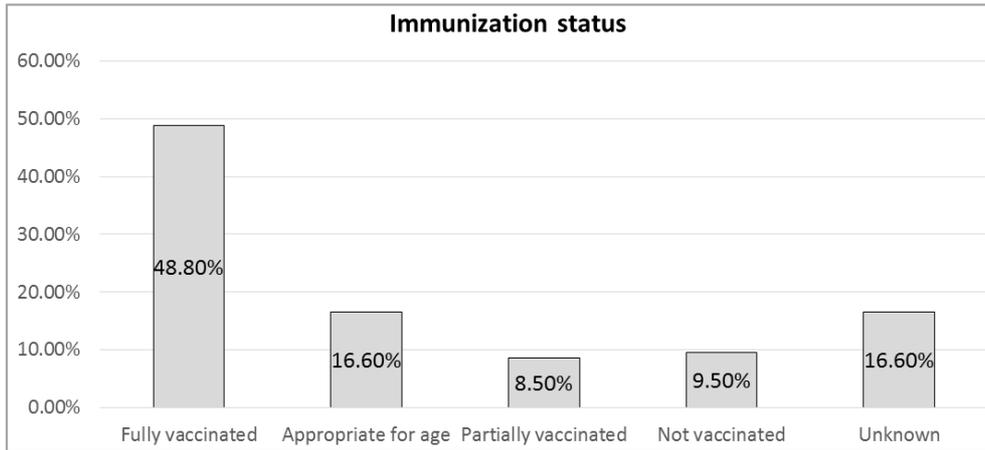


Figure 3. Immunization status of 0-60 months old in Hawassa university comprehensive specialized hospital admitted from September 11, 2018 - June 8, 2019.

Stool examination results revealed 11.8% stool pus, 47.4% doesn't have stool pus and 40.8% of them have no record over stool examination. On the other hand, 8.1% of children have revealed stool parasite while 49.3% haven't and

the remaining charts show no record on stool parasite. Stool RBC examination shows 1.4% positive result, while 56.4% is negative. The rest is being with no record on stool RBC data (Table 11).

Table 11. Stool examination results of children 0-60 months old in Hawassa university comprehensive specialized hospital admitted from September 11, 2018 - June 8, 2019.

	Yes		No		No record		Total	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
tool pus cell	25	11.8	100	47.4	86	40.8	211	100
Stool parasite	17	8.1	104	49.3	90	42.7	211	100
Stool RBC	3	1.4	119	56.4	89	42.2	211	100

Of the 211, only 1.4% had hemoparasites seen on blood film examination, the majority 66.8% have no hemoparasites seen in their blood film. For the rest 31.8% of the study subjects blood film was not done.

WBC was positive in 28.9% and negative in 29.9% of urine analysis reports while 41.2% did not have results for this laboratory investigation. Urine RBC was positive at 23.2% and negative at 35.5%. Urine bacteria was positive in 7.1% and negative in 49.8% of the rest (Table 12).

WBC was positive in 28.9% and negative in 29.9% of urine

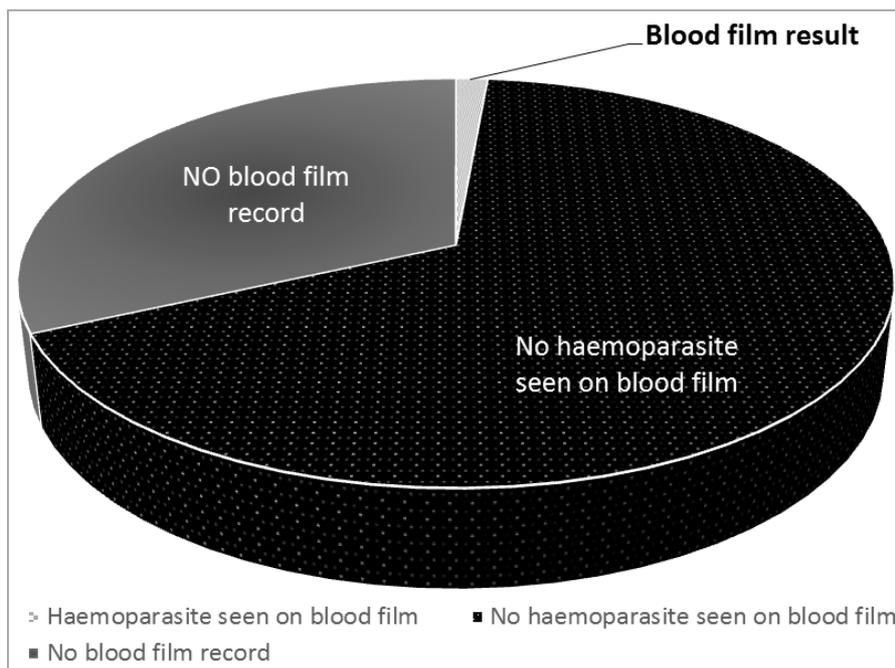


Figure 4. Blood film results of 0-60 months old in Hawassa university comprehensive specialized hospital admitted from September 11, 2018 - June 8, 2019.

Table 12. Urinalysis results of children 0-60 months old in Hawassa university comprehensive specialized hospital admitted from September 11, 2018 - June 8, 2019.

Urinalysis	Positive		Negative		No record		Total	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
WBC	61	28.9	63	29.9	87	41.2	211	100.0
RBC	49	23.2	75	35.5	87	41.2	211	100.0
Epithelial cells	35	16.6	88	41.7	88	41.7	211	100.0
Casts	14	6.6	106	50.2	91	43.1	211	100.0
Bacteria	15	7.1	105	49.8	91	43.1	211	100.0

The majority (52.6%) did not have any chest x-ray records, while 18% of those with records are normal chest x-ray, 21.3% suggest pneumonia, and 4.3% suggest findings that correlate with tuberculosis (Table 13).

Table 13. Chest x-ray findings of children 0-60 months old in Hawassa university comprehensive specialized hospital admitted from September 11, 2018 - June 8, 2019.

Chest x-ray results	Frequency	Percent
No records	111	52.6
Normal	38	18.0
Suggests pneumonia	45	21.3
Suggests tuberculosis	9	4.3
Cardiomegaly	4	1.9
Pleural effusion	1	0.5
Others	3	1.4

3.10. Duration of Hospital Stay

Among 211 children, 71.09% stayed in the hospital for less than 20 days while 23.22% of them stayed for b/n 21 and 40 days. Only 3.79% of children stayed for b/n 41 and 60 days and the remaining 1.89% stayed for >60 days (Table 14).

Table 14. Duration of hospital stay of children 0-60 months old in Hawassa university comprehensive specialized hospital admitted from September 11, 2018 - June 8, 2019.

Number of days	Frequency	Percent
<20 days	150	71.09
20-40 days	49	23.22
41-60 days	8	3.79
>60 days	4	1.89

4. Discussion

Generally, severe malnutrition affected around 49.3% of under-five years of age children. Among those children, a positive relationship was found between age and edema. The relationship between age and edema is a significant finding of our study. As shown in table 15, the prevalence of edema is doubled after infancy being peak between one and three years of age.

The prevalence of severe wasting is different in different age groups. As age increases the risk of developing severe wasting decreases as the table below shows 47.7% of children are under 1 year of age and 32.3% are between 1 and 3 years of age while 20% are between 3 and 5 years which is decreasing in prevalence as age group increases.

Our study showed that generally severe malnutrition is slightly found more in males which is 51.93% while in females is 48.07%. Among these children who developed edema, 48.33% of them are males and the remaining 51.77% are females. While among children who developed severe wasting 53.85% are males and the remaining 46.15% are females. From this result, we understand that the risk of

malnutrition is slightly affected by gender differences. We can also conclude that edema is slightly more common in females while severe wasting is more in males.

The prevalence of severe wasting is different in different age groups. As age increases the risk of developing severe wasting decreases as the table below shows 47.7% of children are under 1 year of age and 32.3% are between 1 and 3 years of age while 20% are between 3 and 5 years of age which is decreasing in prevalence as age group increases (Table 16).

Table 15. Relationship between age and edema of children 0-60 months old in Hawassa university comprehensive specialized hospital admitted from September 11, 2018 - June 8, 2019.

Age (year)	Edema (%)	Severe wasting (%)
<1	23.33	47.7%
b/n 1 and 3	50	32.3%
b/n 3 and 5	26.66	32.3%
Total	100	100

There can be a different mechanism for the explanation of this relationship. Most of the time children start to explore their vicinity at this age group and as a result, the risk of

contamination will be increased which in turn increases the risk of contamination. The other one is in our country this age group is considered the right time for most children to wean from breastfeeding. This condition predisposes to infection due to loss of acquired maternal immunity. Therefore, infection or exposure to bacterial endotoxins may increase the production of free radicals and oxidative stress which may lead to edema.

Infection is found to be significantly high in edematous malnutrition as shown in the table below table 16.

The relationship between infection and edema can be explained bidirectionally. Considering infection is a cause of

malnutrition by increasing body metabolic rate and demand, loss of appetite, increased loss of nutrients and electrolytes in the form of diarrhea, and malnutrition as a precipitating factor for infection by decreasing the immune status of the individual.

As we can see from the table below; children with TB were more likely to present with edema. Because the risk of dissemination to the liver will be increased as well as it's with its chronic infectivity. TB was associated with wasting, as a result of increased resting energy expenditure and anorexia. Wasting could be due to cytokine-induced impairment of amino acid utilization for protein synthesis.

Table 16. Association of infection with edema and severe wasting of children 0-60 months old in Hawassa university comprehensive specialized hospital admitted from September 11, 2018 - June 8, 2019.

	Edema in %	Severe wasting in %
Children with TB	20%	23.07
Children with pneumonia	61.66	69.2
Children with AGE	35	38.46
Children with pyogenic meningitis	6.66	7.69

The other one is the association between pneumonia with edema and severe wasting in which we can see a strong relationship. The above table shows us among children diagnosed with pneumonia 61.66% and 69.2% of them had edema and severe wasting respectively.

The result of our study is quite different from the result of the study which was done in Botswana Nyangabgwe referral hospital eight years back which showed 49.6% of the children were edematous and 72.5% were severely wasted [5]. This may be due to different socio-economic and cultural factors between the two communities.

1.5% of all severely wasted and 1.6% of edematous patients were constituted by children who were exclusively breastfed for less than 6 months. Children on complementary food take the lion's share of the severely wasted and edematous population constituting 86.15% and 95% respectively. Those children who were less than 6 months in age but still on exclusive breastfeeding comprise 7.6% of severely wasted and 3.3% of the edematous population. 0% of the population with edema is made out by patients who were less than 6 months and on mixed feeding or on replacement feeding but 1.5% and 3.07% of the severely wasted patients are comprised of these patients respectively.

5. Conclusion

The following conclusions can be drawn from the present study. First, the proportion of severe malnutrition with severe wasting without edema versus edematous malnutrition is age dependent. In general, edematous malnutrition peaks at between 1 and 3 years of age, whereas severe wasting peaks in under one year of age children. Second, infections like pneumonia, acute gastroenteritis, and tuberculosis are the most common cause of secondary malnutrition. Finally, adequate, and proper complementary feeding and infection prevention are potential ways to reduce the prevalence of

edematous nutrition.

6. Recommendation

Health education dissemination should be made to create awareness of the importance of exclusive breastfeeding, and timely complementary feeding.

Various strategies of infection prevention like timely vaccination and sanitary living conditions should be made available.

Conflict of Interests

All the authors do not have any possible conflicts of interest.

Abbreviation

CBC: Complete Blood Count
 CBE: Community-based education
 CI: Confidence interval
 EDHS: Ethiopian Demographic and Health Survey
 ESR: Erythrocyte Sedimentation Rate
 HUCSH: Hawassa University Comprehensive Specialized Hospital
 JUSH: Jima University Specialized Hospital
 NCHS: National Center for Health Statistics
 OR: Odds ratio
 RBC: Red Blood Count
 RVI: Retroviral Infection
 SD: Standard Deviation
 SPSS: Statistical Package for Social Sciences
 TB: Tuberculosis
 UN: United Nations
 UNICEF: United Nations Children's Fund
 WHO: World Health Organization

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