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Research Article

Prevalence of Severe Acute Malnutrition (SAM) and Associated Factors Among Children at Gacan Libaax MCH, Qardho, Puntland, Somalia

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Abstract

A major national and international public health concern, severe acute malnutrition (SAM), affects millions of children globally, particularly those under five. Understanding the incidence of SAM and its contributing factors in children under five at the Ga'an Libah MCH Center in Qardho was the study's goal. The source population consists of children aged 0-59 months. The study indicated that parents lacked increased awareness of better nutritional outcomes for their children, the importance of breastfeeding, and the recommended breastfeeding rates; additionally, many of these children either missed vaccinations or received incomplete vaccinations. For the primary causes of stunting and wasting, there is no discernible gender difference. As a result, the findings concurred with the World Health Organization (WHO) definition of Severe Acute Malnutrition (SAM) based on standard clinical indicators such as mid-upper arm circumference (MUAC) of less than 11.5 cm or the presence of nutritional oedema (swelling). Penultimately, the study at Ga'an Libah MCH Centre in Qardho, Somalia, found an alarming SAM: MUAC < 11.5 cm, MAM: MUAC ≥ 11.5 cm and < 12.5 cm, and MUAC ≥ 12.5 cm, respectively, among children aged 6-59 months. Comprehensive interventions that address both the region's immediate dietary requirements and underlying socioeconomic and environmental causes are desperately needed. Finally, expand SAM and MAM screening and treatment initiatives while ensuring services are easily accessible, and also encourage the best Infant and Young Child Feeding (IYCF) practices.

Keywords

Severe Acute Malnutrition, Mid-upper Arm Circumference, Bilateral Pitting Oedema

1. Introduction

In order to lower mortality and encourage the best possible nutrition and development for Somali children, it is imperative that acute malnutrition be managed. The prevalence of acute malnutrition varies significantly by area. Chronic nutrition crises usually affect children in areas most vulnerable to violence, relocation, and lack of access to essential services. Millions of children worldwide, especially those under five, suffer from severe acute malnutrition (SAM), a serious national and international public health issue [11]. The World Health Organization endorsed standards for diagnosis of severe acute malnutrition

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(SAM) are a weight-for-height/length Z-score (WHZ) of <− 3Z, a mid-upper-arm circumference (MUAC) of < 15 cm, nutritional oedema or any amalgamation of these parameters. It can be moderate (MAM) or severe (SAM) and can affect at least 19 million children at any one time [2, 5, 6]. Severe Acute Malnutrition (SAM) is characterised by a significant deficit in weight-for-height ratio, bilateral pitting oedema, or a mid-upper arm circumference (MUAC) below a certain threshold [18]. WHO maintains that the only way to detect children who are severely malnourished is through MUAC, and the idea seems to be widely accepted [7]. The major contributing factors to acute malnutrition include very poor quality and inadequate dietary intake, high prevalence of diseases, limited access to safe water, and elevated levels of acute food insecurity [8]. About 45% of child mortality in low- and middle-income nations, like Somalia, were caused by SAM, which was predicted to have affected 34.2 million children under the age of five (5) in 2022 [17]. Sub-Saharan Africa stands at the forefront of the malnutrition crisis, with a prevalence rate of SAM far exceeding global averages, especially among women and children [14]. Factors such as food insecurity, poverty, inadequate access to healthcare, and recurring environmental shocks exacerbate the vulnerability of children in the region. Limited resources and infrastructure further impede effective interventions, perpetuating cycles of malnutrition and poverty across generations [3]. In terms of acute malnutrition, between July 2025 and June 2026, an estimated 1.85 million children aged 6–59 months are expected to suffer acute malnutrition (GAM). This includes approximately 421,000 children likely to suffer severe acute malnutrition (SAM). Most of these children are concentrated in southern Somalia. Compared to the same season last year, the current estimates represent a 12 per cent increase in GAM and a 5 per cent increase in SAM [8].

The "Severe" nutrition classification suggests a considerable risk of severe acute malnutrition cases within the vulnerable population, even though the precise prevalence of SAM in Qardho is still unknown [12]. The necessity for more study to obtain a thorough grasp of SAM prevalence and related determinants in children under five throughout Qardho is highlighted by these limitations in the data that is currently available. The primary goal of this study is to ascertain the prevalence of SAM and identify its associated factors among children under five years old at Ga'an Libah MCH Center in Qardho. Therefore, filling in the gaps in data compilation regarding the prevalence of SAM and its associated factors is essential for evaluating progress and guiding future interventions.

2. Research Area, Population and Design

The study area for this research is Qardho, a town situated in the northeastern region of Somalia. This location is essential for examining the environmental factors associated with SAM among children under five years old. Qardho is characterised by fluctuating socio-economic conditions, akin to many other areas in Puntland, where access to safe water, adequate sanitation facilities, and standardised health services remains severely limited. These challenges significantly impact the health and nutritional status of young children in the community. The Ga'an Libah MCH, a prominent health facility in the area, provides crucial maternal and child health services, making it an appropriate site for this research. Source Population: The source population consists of children aged 0-59 months who visited the Ga'an Libax Mother and Child Health (MCH) centre during the designated study period. The study population was 288 children of the age between 0 and 59 months who were randomly selected from the source population during the study period, based on specific inclusion and exclusion criteria. The exclusion ones are children who have been previously treated for severe acute malnutrition within the last three months and residing outside the study area (Qardo town) during the study period. Sample size was selected from any children under five years in Ga'an Libax MCH, Qardho, Puntland, Somalia. Data was collected using structured questionnaires and anthropometric measurements. The questionnaires were designed to capture demographic information, socio-economic status, and environmental factors related to SAM. Anthropometric measurements, including mid-upper arm circumference and head circumference (cm), correlated with the severity of malnutrition, have been taken to assess the nutritional status of the respective child. Trained field workers conducted the measures to ensure accuracy and consistency. The data was processed by using statistical packages such as Excel, Python, and R, and the result was analysed and presented in graphics, tables and charts.

2.1. Demographics and Socio-Economic Status (SES)

Socio-demographic information on distribution of under-five children by sex and age, as well as information on the carers, including their relationship to the child and their age; socio-economic factors and primary household income sources; The highest level of education completed by the child's father and mother/primary carer; whether the child was ever breastfed and the rate of breastfeeding; and the age in months when complementary foods were first introduced. In addition, environmental and health factors such as the primary source of daily drinking water, treating drinking water before giving it to your child, and the type of toilet facility the household uses, Whether the child has had diarrhoea in the past two weeks, whether the child has had a respiratory problem in the past two weeks, and finally whether they have received all routine vaccinations appropriate.

2.2. The Children's Nutritional Status

The children's nutritional status was assessed using the standard deviation from the WHO median in the age- and sex-specific WHO child growth standards charts (Multicenter

Growth Reference Study, MGRS) as a Z score of <-2 standard deviation (SD) Z-score value labelled as 'moderate undernutrition' and <-3 SD Z-score value labelled as 'severe undernutrition'. The maximum circumference of the head from the occipital protuberance to the supraorbital ridges on the forehead was measured by wrapping a non-stretchable tape around the cranial vault. A second measurement was taken to validate the results if they were anomalous. Bilateral pitting oedema and its grades of severity were assessed by observing stretched skin, dimples after pressure (pitting), and increased size of limbs. Both feet were pressed with the thumbs for 3 full seconds, and then the thumbs were removed. By observing if the skin stays depressed on both feet, the child has bilateral pitting oedema and is graded. The same test was done on the lower legs, hands, and lower arms, and it was observed if the skin stayed depressed in these areas. Further, swelling in the face, especially around the eyes, was examined. This design can provide a snapshot of the health status of children in the region, facilitating the identification of high-risk groups. Data was collected using structured questionnaires and anthropometric measurements. The questionnaires were designed to capture demographic information, socio-economic status, and environmental factors related to SAM. Anthropometric measurements, including mid-upper arm circumference, by using the WHO-recommended MUAC tape and procedure, to assess nutritional status. Trained field workers conducted measures to ensure accuracy and consistency. The study's participants were chosen using a straightforward random selection technique. This method reduces selection bias by guaranteeing that each child under five who attends the Ga'an Libah MCH has an identical probability of being included in the sample. The staff at the centre will periodically update the list of eligible children to reflect the most recent attendance records in order to preserve the integrity of the sample. This simple approach preserves the integrity of the sample while enabling effective data collecting. Data Analysis and Presentation: The statistical packages for the social sciences Excel, R, and Python were used to process the data, and graphics, tables, and charts were used to evaluate the results. Which provide the percentage and proportion of the data collected from the respondent questionnaire and data collected from secondary sources. The fourth ethical measure is a principle that makes it easy for users of study findings to comprehend the researcher's conclusions and suggestions.

2.3. Ethical Considerations

Before starting the investigation, ethical approval was acquired from the appropriate institutional review board. Every participant gave their informed consent after being made aware of their rights and the goal of the study. Throughout the trial, data was securely stored, and participants were given unique identifying numbers to protect their privacy. Participants were additionally informed that they could leave the study at any time without it affecting their ability to receive medical care.

3. Results

The data gathered, as aforesaid, to investigate the prevalence of Severe Acute Malnutrition (SAM) and its associated factors among children under five years of age is divided into four sections (A-D) addressing demographic, socioeconomic, environmental/health, and anthropometric factors, respectively. The findings are presented using tables and accompanying textual descriptions to provide a comprehensive overview of the study's quantitative results, structured around the research questions outlined above.

3.1. Demographic Information

This section presents the sociodemographic characteristics of the sample, detailing the distribution of under-five children by sex and age, as well as information on the caregivers, including their relationship to the child and their age. Based on the age of the child (in months), 39% were between 12 and 21 months old, 25% were between 34 and 45 months, 19% were between 22 and 33 months, 10% were between 4 and 11 months, and 7% were between 46 and 59 months old (the smallest group). Single-factor analysis of variance was performed with a P-value of $2.135x10^{-28}$. Further, the two-sample t-test assuming unequal variances showed that all age groups were significantly different from one another, except for the groups aged 22-33 months and 34-45 months, as well as the groups aged 4-11 months and 46-59 months.

Table 1. *Key participants' demographic characteristics. Child's age, people living in the household and its size, and their demographic characteristics.*

Child's age	Frequency	Percentage (%)_	P-value
4-11 months	28	10%	$2.14x10^{-28}$
12 -21 months	113	39%	
22-33 months	56	19%	0.56

Child's age	Frequency	Percentage (%)_	P-value
34-45 months	72	25%	
46-59 months	19	7%	0.1410
	288	100%	
Child sexual category	Frequency	Percentage	P-value
Female	153	(53%)	$1.6x10^{-1}$
Male	135	(47%)	
Total	288	100%	
People living in household	Frequency	Percentage	
<4 people	105	36%	
5-8 people	120	42%	
>8 people	63	22%	
Total	288	100%	
Primary source of income	Frequency	Percentage	p-value
Formal employment	98	34%	$1.51x10^{-26}$
Informal employment (e.g., daily labor)	23	8%	
Business/trade	17	6%	$2.45x10^{-87}$
Remittances	120	42%	$1.8x10^{-6}$
Other	30	10%	
Total	288	100%	

As far as the sexual category, the majority of child sexes were female (153 (53%)), and 135 (47%) were male, in which the two are not significantly different from each other with a p-value of $1.6x10^{-1}$. As far as the household size, including the child and respondents alike, the results indicate that the most frequent household size consists of 5-8 people, accounting for 42% of the households surveyed. Approximately 36% of households have fewer than 4 people, while 22% have more than 8 people residing within. The data encompasses a total of 288 households, providing a comprehensive overview of household size distribution in the study population (Table 1).

The primary income sources for 288 households show that remittances are the most noteworthy, accounting for 42% with a significance of $2.45x10^{-87}$ when performing a single-factor ANOVA, suggesting a reliance on external financial support. A two-sample t-test assuming unequal variances was employed to ascertain the above; that is, if the two largest modes of income are significantly different, and the rest showed that is the case, with remittance ominously higher than formal employment with a p-value of $1.8x10^{-6}$. And formal employment provides income for 34% of households. Informal employment and business/trade are less prevalent, at 8% and 6%, respectively. An "Other" category makes up 10%, indicating additional income sources. The data highlights varied economic sources, with an emphasis on remittances and formal employment.

3.2. Level of Education of the Parents

The data on the highest level of education completed by the child's father and mother, for that matter, indicates that, among the 288 respondents, when executing a single-factor ANOVA, a significant number (41% and 47% correspondingly) have no formal education, with a p-value of $6.32x10^{-40}$ and $4.36x10^{-72}$, respectively. Approximately 30% completed primary school, while 18% at maximum reached the level of secondary school (completed or not). Only 13% of the fathers and a mere 4% of the mothers attained some form of higher education, whether completed or not (Table 2).

Table 2. The highest level of education completed by the child's father and mother/primary carer.

The highest level of education completed by the child's parents father and mother	Frequency (Father)	Percentage	P-Value	Frequency (Mother)	Percentage	P-Value
No formal education	120	41%	$6.32x10^{-40}$	135	47%	$4.36x^{-72}$
Primary school	86	30%		90	31%	
Secondary school	45	16%		51	18%	
Higher education	37	13%		12	4%	
Total	288	100%		288	100%	

3.3. Whether the Child Was Ever Breastfed and the Rate of Breastfeeding

When looking at if the respective infants were ever nursed, it showed that 90% (259) of the 288 (with a P-value of $1.13x10^{-124}$) children were breastfed and 10% (29) were not (Table 3). This suggests that breastfeeding is very common among the study's children.

Table 3. Whether the child was ever breastfed and the rate of breastfeeding.

Whether the Child Was Ever Breastfed	Frequency	Percentage	P-value
Yes	259	90%	$1.13x10^{-124}$
No	29	10%	
Total	288	100%	
Rate of breastfeeding	Frequency	percent	
Less than one month	41	16%	
1 to three months	36	14%	
Four to five months	55	21%	
Six months	83	32%	$2.1x10^{-16}$
More than six months	44	17%	
Total	259	100%	

As far as the duration of exclusive breastfeeding among children is concerned, the largest number of them are breastfed in a six-month period, and that is a highly significant number when performing a single-factor ANOVA with a p-value of $2.1x10^{-16}$. This distribution shows that while a majority of the children were exclusively breastfed, the duration varied, with a substantial proportion reaching the 6-month recommendation as per Table 3.

3.4. Complementary Feeding

3.4.1. Age in Months When Complementary Foods Were First Introduced

The age at which complementary foods were first introduced to the child indicates that 10% (29) of the children were introduced to complementary foods before 4 months of age, while 26% (74) were introduced between 4 and 5 months. A significant 32% (92) were introduced at 6 months, and that is highly significant compared to the rest with a p-value of

$1.6x10^{-38}$, and 9% (27) were introduced after 6 months. Furthermore, a P-value of $2.79x10^{-1}$ indicates that there is no significant difference between the two parameters, which are 4-5 months after the introduction of complementary foods and children who have not yet eaten complementary foods. This distribution suggests that while many children were introduced to complementary foods around the recommended age of 6 months, a notable proportion were not introduced to the complementary food or were introduced to it either earlier or later (in the discussion).

Table 4. *Age in Months When Complementary Foods Were First Introduced.*

Age in Months When Complementary Foods Were First Introduced	Frequency	Percentage	P-value
Less than 4 months	29	10%	
4-5 months`	74	26%	$2.79x10^{-1}$
6 months	92	32%	$1.6x10^{-38}$
More than 6 months	27	9%	
Child is not yet eating complementary foods	66	23%	
Total	288	100%	

The Foods supplement Usually Eaten by Child	Frequency	Percentage	P-value
Cereals (e.g. rice & maize)	43	15%	
Legumes (e.g. Beans & lintils)	60	21%	
Vegetables	80	28%	$2.5x10^{-11}$
Fruits	39	14%	
Animal products (e.g. meat, milk, egss)	66	23%	
Total	288	100%	

How many times per day child eats solid, semi-solid, or soft foods (Breast Milk not included in here)	Frequency	Percentage	P-value
1 time per day	0	0%	
2 times per day	57	20%	
3 times per day	115	40%	$1.4x10^{-40}$
4 or more times per day	87	30%	
Less than once a day / Not eating solids yet	29	10%	
Total	288	100%	

3.4.2. The Foods Supplement Usually Eaten by Child

The foods usually eaten by the studied children present a detailed breakdown of dietary habits within the studied group. The data reveals that vegetables, animal products, and legumes are sequentially the most frequently consumed food categories, each accounting for 28% (with a significance of $2.5x10^{-11}$). This distribution suggests a diet heavily reliant on vegetables and animal products, with moderate consumption of legumes and cereals, and a relatively moderate intake of fruits.

3.4.3. The frequency of Supplement

The frequency a child eats solid, semi-solid, or soft foods, excluding breast milk, per day indicates that the majority of children eat these types of food three times a day (40%), with a significance of $1.4x10^{-40}$, followed by those who eat four or

more times a day (30%). A smaller proportion eats twice a day (20%), and very few eat only once a day (0%) or consume solids less than once a day or not at all (10%). According to this distribution, the majority of kids have made the switch to eating solid, semi-solid, or soft foods several times a day, with a significant portion doing so at least three times per day. (in the discussion) (Table 4).

4. Environmental and Health Factors

4.1. Primary Source of Daily Drinking Water

In here the data reveals that tap water is the primary source of drinking water for the majority of respondents (53%) with a significance of $6.3x10^{-97}$, indicating widespread access to piped water systems. Protected wells or boreholes serve as the primary source for a significant portion of the population (32%), suggesting also the reliance on groundwater sources. Unprotected wells account for 10%, highlighting a potential risk of water contamination. A small percentage (5%) relies on other sources, while none reported using streams directly. It's noteworthy that unprotected wells and other sources are not significantly different, with a p-value of $2.00x10^{-2}$ (Table 5).

Table 5. *Drinking Water and whether treated Before Giving It to Your Child.*

Primary source of daily drinking water	**Frequency**	**Percentage**	**P-value**
Tap water	152	(53%)	$6.3x10^{-97}$
Protected wells or boreholes	92	(32%)	
Unprotected wells	29	(10%)	$2.00x10^{-2}$
other sources	15	(5%)	
Total	288	100%	
Treating drinking water before giving it to your child	**Frequency**	**Percentage**	
Yes	198	69%	$1.8x10^{-31}$
No	90	31%	
Total	288	100%	
The type of toilet facility the household uses	**Frequency**	**Percentage**	
latrine with a slab	132	46%	$8.03x10^{-63}$
Flush toilets	63	22%	
latrines without a slab	81	28%	$2.61x10^{-2}$
open defecation	12	4%	
Total	288	100%	
Whether the Child Has Had Diarrhea in the Past Two Weeks	**Frequency**	**Percentage**	**P-Value**
Yes	244	85%	$2.x10^{-92}$
No	44	15%	
Total	288	100%	

Whether the child has had a respiratory problem in the past two weeks	Frequency	Percentage	P-Value
Yes	216	75%	$3.42x10^{-53}$
No	72	25%	
Total	288	100%	

whether received all routine vaccinations appropriate	Frequency	Percentage	P-Value
The children have received all routine vaccinations	124	(43%)	$2.84x10^{-21}$
The children had incomplete vaccinations	100	(35%)	$2.8x10^{-7}$
either don't know or do not have a vaccination card available	64	(22%)	
Total	288	100%	

4.2. Treating Drinking Water Before Giving It to Your Child

Survey results indicate that 198 (69%) of respondents treat drinking water before giving it to their children with a significance of $1.8x10^{-31}$, demonstrating a high level of awareness regarding water quality. However, 90 (31%) do not treat the water.

4.3. The Type of Toilet Facility the Household Uses

The most common type of toilet facility used by households is a latrine with a slab, accounting for 132 (46%) of the total, and that is highly significant from the rest of the types of toilets used by the surveyed households with a significance of $8.03x10^{-63}$ when single-factor ANOVA is employed. Flush toilets are used by 63 (22%) of households, while 81 (28%) rely on latrines without a slab, and there is a significant difference between the two types of toilets when tested on the t-test: Two-Sample Assuming Unequal Variances with a significance of $2.61x10^{-2}$. A concerning 12 (4%) of households still practise open defecation.

4.4. Whether the Child Has Had Diarrhea in the Past Two Weeks

The highly significant majority of the children tested (85%) have experienced diarrhoea, fever, or a cough in the past two weeks with a significance of $2x10^{-92}$, when tested on the t-test: two-sample assuming unequal variances. Only 15% of children did not experience any of these symptoms.

4.5. Whether the Child Has Had a Respiratory Problem in the Past Two Weeks

A substantial proportion of children, specifically 75%, with a significance of $3.42x10^{-53}$, have experienced a respiratory problem in the past two weeks with a significance of $3.42x10^{-53}$. Conversely, 25% of children did not have any respiratory issues during the same period.

4.6. Routine Vaccinations Such as Those for Measles, Polio, and DPT

Based on the gathered data, 124 (43%) of the children have received all routine vaccinations appropriate for their age, including those for measles, polio, and DPT, with a significance of $2.84x10^{-21}$. However, 100 (35%) of the children have missed or have incomplete vaccinations. The aforementioned results are, nevertheless, significantly different from each other with a p-value of $2.8x10^{-7}$. Additionally, 64 (22%) of respondents either don't know or do not have a vaccination card available.

5. Anthropometric Measurement

5.1. Mid-Upper Arm Circumference (MUAC) for Children 6-59 Months

A snapshot of the Mid-Upper Arm Circumference (MUAC) measurements for children aged 6-59 months reveals a concern about nutritional status. Consequently, 61 (21%) of the children have a MUAC of less than 11.5 cm with a significance of $4.62x10^{-30}$ when performed a single factor of ANOVA, indicating Severe Acute Malnutrition (SAM) (Table 6).

Table 6. Mid-Upper Arm Circumference (MUAC) for children 6-59 months.

Mid-Upper Arm Circumference (MUAC) for children 6-59 months	Frequency	Percentage	P-value
SAM: MUAC < 11.5cm	61	21%	$4.62x10^{-30}$
MAM: MUAC ≥ 11.5 cm and < 12.5 cm	115	40%	
Normal: MUAC ≥ 12.5 cm	112	39%	
Total	288	100	

5.2. Bivariate Analysis Logistic Regressions

Performing further bivariate analysis Logistic regression analysis to ascertain the effect of each independent variable (the age of the children tested) on the child's status of malnutrition. Accordingly, the odds of child age in months (6 to 17; 18 to 29; 30 to 41; 42 to 59) based on the gender of the child that suffers MUAC <11.5 cm (<-3 SD Z-score) were examined. And, accordingly, comprehend if the tested attributes had significant associations with each other at 95% CI. As a result, in testing the effect of the age of the child on mean MUAC, the odds of being a male were found to be 0.008 (-3.67, -4.76) times higher, though the difference was not statistically significant with a p-value of $9.8X10^{-1}$. The same is true when tested ≥ 11.5 cm and < 12.5 cm (between <-3 and <-2 SD Z-score) and ≥ 12.5 cm (<-2 SD Z-score) against the child's age with p-values of $8.9X10^{-1}$ and $4.94X10^{-1}$, respectively, and the odds of being a male were found to be 0.007 (-3.84, -5.03) and 0.004 (-4.78, -5.67) at 95% CI. Table 7.

Table 7. Mid-Upper Arm Circumference (MUAC) for children 6-59 months.

(MUAC) for children 6-59 months	Z-score	Frequency	Bivariate analysis OR (95% CI)	P-value
SAM: MUAC < 11.5cm Combined (n = 61) Boys (n = 25) Girls (n = 29)	Z-score<−3 SD Severe Wasting	61 (21%)	0.008 (-3.67, -4.76) Reference	$9.8x10^{-1}$
MAM: MUAC ≥ 11.5 cm and < 12.5 cm Combined (n = 115) Boys (n = 50) Girls (n = 65)	Z-score<−2 SD Moderate Acute Malnutrition	115 (40%)	0.007 (-3.84, -5.03) Reference	$8.9x10^{-1}$
MUAC ≥ 12.5 cm Combined (n =112) Boys (n = 50) Girls (n = 65)	MUAC/Z-score < 1 SD Wasting	112 (39%)	0.004 (-4.78, -5.67) Reference	$4.9x10^{-1}$
Total		288 (100%)		

5.3. Mean Head Circumference of Studied Children

Measurements of head circumference (HC) were tested to determine whether there were any significant morphological alterations in the brains that might impair intellectual capacity and result in smaller brains. The objective is to investigate how malnutrition affects a child's head size and development quotient (DQ). The average head circumference, based on the deviation from the WHO median in the age- and sex-specific WHO child growth standards charts (Multicenter Growth Reference Study, MGRS), is a Z score between <−3SD and <−2SD for both boys and girls; additionally, the child's age is adjusted as an independent variable when assessing the child's nutritional status according to their gender. Consequently, determine whether there were significant correlations between the tested features at 95% confidence intervals. Accordingly,

the odds of the child being a boy were tested in reference to the child being a girl, and the results were presented in table mode (Table 8). As a result, in testing the head circumference based on age range in months, the odds of the child's being a boy's head circumference were 0.0004 (-7.07, -7.63) higher with a P-value of $9.8x10^{-1}$. The difference was not statistically significant to those of girls.

Table 8. Head circumference tested on age.

Variables		Conditions				
Mean HC (cm)	Z-score range <−3 SD and <−1 SD	Head circumference based on age rage in Months		Bivariate analysis OR (95% CI)	χ^2	p-value
Gender		6 to 17	18 to 29			
Male Female	<−3 SD and <−2 SD	34.7 34.9	44.3 44.6	0.0001 (-6.97, -7.59) Reference	$9.8x10^{-6}$ Reference	$9.8x10^{-1}$
		6 to 17	30 to 41			
Male Female	<−3 SD and <−2 SD	34.7 34.9	45.5 45. 6	0.0005 (-7.02, -7.64) Reference	$1.2x10^{-4}$ Reference	$9.9x10^{-1}$
		6 to 17	42-59			
Male Female	<−3 SD and <−2 SD	34.7 34.9	46.9 47.3	0.0004 (-7.09, -7.63) Reference	$17.6x10^{-5}$ Reference	$9.9X10^{-1}$
		18 to 29	30 to 41			
Male Female	<−3 SD and <−2 SD	44.3 44.6	45.5 45. 6	0.0005 (-7.06, -7.64) Reference	$2.3x10^{-4}$ Reference	$9.9X10^{-1}$
		18 to 29	42-59			
Male Female	<−3 SD and <−1 SD	44.3 44.6	46.9 47.3	0.0004 (-7.13, -7.63) Reference	$3.5x10^{-5}$ Reference	$9.9X10^{-1}$
		30 to 41	42-59			
Male Female	<−2 SD and <−1 SD	45.5 45. 6	46.9 47.3	0.0004 (-7.13, - 7.63) Reference	$4.6x10^{-4}$ Reference	$9.8X10^{-1}$

5.4. Presence of Bilateral Pitting Edema

Based on the anthropometric measurement result, the presence of bilateral pitting oedema was assessed from the studied children, and its severity and grades were catalogued. observed in the studied population. 4% (12) of the individuals shown had Grade++ Moderate (in both feet plus lower legs) with bilateral pitting oedema, while 96% (276) did not. This indicates that nearly a quarter of the studied group exhibited this sign, which can be associated with various underlying health conditions, including malnutrition, heart failure, or kidney disease.

6. Discussions and Recommendations

In order to provide a thorough overview of the research questions mentioned above, the first section of the study focused on demographic, socioeconomic, and environmental/health factors, and the second one on anthropometric factors in relation to the prevalence of severe acute malnutrition (SAM) in children under five years of age. And the final section has been following up on the existence of bilateral pitting oedema, which was assessed from the studied children, and cataloguing its severity and degrees. As for the demographic information on the children's age range, the only noticeable thing is that 240 of the children examined are in the range of 12-45 months of age, which is 83% of the tested children, and only 17% are in the two extremes. Another factor that could have a knock-on effect on the child's nutritional status could be the household size, where the income of the family is predicated upon the financial status of the household. On that note, 76% of the household income is either remittances, support from the diaspora relatives, or formal employment. That could

have an effect, as more often than not the outside support and employers are not reliable sources of income in Somalia. And that could have the nutritional status of the child in the respective families. Another factor that has some effect on the nutritional shortcomings is the education completed by the child's father and mother that increases the awareness of the parents of the better child nutritional outcomes, reducing risks of malnutrition, stunting, and excessive weight gain [9]. Thus, this distribution suggests that a substantial proportion of the children's parents have limited formal education, with a minority having progressed to higher levels of education. Another factor considered in the matter was whether the child was ever breastfed and the rate of breastfeeding, which found that 90% (259) of the 288 children were breastfed. In addition, based on the current status of the children examined and whether the child is currently being breastfed, it shows that out of 288 children, 58% (166) are currently being breastfed, while 42% (122) are not. This indicates that more than half of the children are still receiving breast milk at the time of the survey. Earlier studies conducted indicated correlation between breastfeeding and the nutritional status of the child, suggesting that breastfed children were more likely to exhibit better nutritional outcomes [13]. Nevertheless, a large sway of the children examined showed the opposite. This could be explained by the lack of awareness on the side of hospital healthcare workers of exclusive breastfeeding and complementary feeding [4]. Another factor looked at has been age in months when complementary foods were first introduced, and that has shown that this distribution suggests that while many children were introduced to complementary foods around the recommended age of 6 months, a notable proportion (66 (23%)) were not introduced to the complementary food or were introduced to it either earlier or later. A child's health depends on following proper dietary patterns because eating a variety of meals throughout the day increases the likelihood that they will get all the nutrients they need [10, 19]. On that note, the distribution of foods usually eaten by the studied children suggests a diet that is heavily reliant on vegetables and animal products, with moderate consumption of legumes and cereals, as well as a relatively moderate intake of fruits. However, given that dietary supplementation should always be customised to meet the needs of each individual, the studies have demonstrated that, when taking into account the supply of vitamin D and omega-3 fatty acids, it seems justified to increase parents' knowledge in this regard with respect to the use and means to choose the best supplement possible [19]. As far as the primary source of drinking water for the majority of respondents is concerned, it indicates widespread access to piped water systems. This points out the necessity of maintaining tap water infrastructure and ensuring the safety of well water sources to provide clean and accessible drinking water. According to the survey's findings, 69% of participants purify drinking water before supplying it to their kids, indicating a high degree of water quality awareness. 31%, however, do not purify the water. This discrepancy highlights a potential need for further education on the benefits of water treatment, which could be addressed through targeted outreach programmes. The distribution of the type of toilet facility the household surveyed uses indicates a significant need for improved sanitation infrastructure and education to reduce the use of unimproved facilities and eliminate open defecation, promoting better public health outcomes. The high prevalence of diarrhoea among the children surveyed indicates a significant burden of common paediatric illnesses among the population assessed, highlighting the need for improved sanitation practices, increased access to healthcare, and focused interventions to lower the incidence of these ailments. In addition, serious health concerns are raised by the high prevalence of respiratory problems among the children surveyed, indicating the need for more investigation into the causes and the implementation of appropriate interventions to mitigate these challenges. Finally, for routine vaccinations such as those for measles, polio, and DPT, over half, 164 (57%), of the children either missed or have incomplete vaccinations or don't know or do not have a vaccination card available. All the above, particularly missed or incomplete vaccinations, could be contributing factors to children's nutritional status. [1].

Bivariate logistic regression analysis.

Once set out, the Investigated could be a contributing factor to the children's nutritional status of the examined children attending Gacan Libaax MCH, the prevalence of Severe Acute Malnutrition (SAM) and its associated factors among children under five years of age, the children's nutritional status (nutritional status had been assessed), and anthropometric measurements, including mid-upper arm circumference. Also, the maximum circumference of the head was measured. In addition, bilateral pitting oedema and its grades of severity were assessed, and the result was stipulated. As for the Mid-Upper Arm Circumference (MUAC) measurements for children aged 6-59 months, they reveal a concern about nutritional status. Thus, bivariate logistic regressions were employed to analyse the effect of several important risk factors, such as the effect of each independent variable (the age of the children tested) on the child's status of malnutrition, and, accordingly, to comprehend if the tested attributes had significant associations with each other. Thus, the odds of being male were found to be higher, but the difference was not statistically significant on SAM: MUAC < 11.5cm, MAM: MUAC ≥ 11.5 cm and < 12.5 cm, and MUAC ≥ 12.5 cm, respectively. This could be explained by the fact that, unlike the findings in other parts of the region (East Africa) [15, 16] boys and girls are equally malnourished since there are no parental preferences about their diet. Stunting in both boys and girls is mostly determined by exclusive breastfeeding and a sufficient variety of supplemental foods. For the primary causes of stunting and wasting, there is no discernible gender difference. These results highlight the need for appropriate advice about the best feeding strategies for infants and young children.

In order to ascertain whether there were any notable morphological changes in the children's brains that could impair

intellectual capacity and result in smaller brain sizes, as well as how malnutrition affects a child's development quotient (DQ), we also screened the mean head circumference of the children in the same population. Additionally, compared to female children, male children were found to have higher probabilities and be more at risk for SAM, according to multivariate logistic regression analysis. When evaluating a child's nutritional condition based on their gender, the age of the child is also taken into account as an independent variable. Consequently, ascertain whether the tested features had any meaningful relationships. As a result, the odds of the child's being a boy head circumference were higher. However, compared to those of girls, the difference was not statistically significant. Finally, the findings concurred with the World Health Organization (WHO) definition of Severe Acute Malnutrition (SAM) based on standard clinical indicators such as mid-upper arm circumference (MUAC) of less than < 11.5cm, or the presence of nutritional oedema (swelling) [8].

Recommendations

In order to address the high incidence of SAM and its contributing causes among children under five in Qardho District, Puntland, Somalia, the following recommendations are made in light of the study's convincing findings. Thus, comprehensive interventions that address both the region's immediate dietary requirements and underlying socioeconomic and environmental causes are desperately needed. Expand SAM and MAM screening and treatment initiatives while ensuring services are easily accessible. Encourage the best Infant and Young Child Feeding (IYCF) practices, such as exclusive breastfeeding and suitable supplemental feeding, particularly for the age group that is most at risk. Reduce the effect of income on SAM rates by implementing programmes to diversify and stabilise household income, such as microfinance and skills training. Consider implementing targeted social protection programmes for the most vulnerable households. Improve Water, Sanitation, and Hygiene (WASH) Practices. Launch public health initiatives to highlight the significance of properly treating and storing drinking water because of its close connection to SAM. To lower the prevalence of waterborne illnesses, increase access to dependable and safe water sources and encourage good hygiene habits. Encourage close collaboration between the livelihood, WASH, nutrition, and health sectors. Involve communities in the planning and execution of initiatives to guarantee their efficacy and long-term viability. Organise further research to recognise particular obstacles to economic stability and safe water treatment. In order to guide and improve future programmes in similar settings addressing the high burden of SAM in Qardho, Somalia, it requires a concerted and continuous effort from all stakeholders to evaluate the effectiveness of treatments. Implementing these recommendations could result in significant improvements in child health outcomes and the development of a more resilient and nutrient-secure Puntland community. Finally, it's a noteworthy that The results are also limited to a single district in the Karkar region and must be replicated throughout the state.

Abbreviations

BMI	Severe Acute Malnutrition
MAM	Moderate Acute Malnutrition
MCH	Mother and Child Health
MUAC	Mid-upper Arm Circumference
BPO	Bilateral Pitting Oedema

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Conflicts of Interest

The authors declare that there are no conflicts of interest in this work.

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