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Risk Factors of Severe Acute Malnutrition among Under-five Children in Al-Nohud Western Kordufan State: Cross-Sectional Study

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Abstract

Background: Malnourishment is still conceder a severe public health and progress issue, not just in evolving populations but everywhere in the world. Because it outcomes in the losses of 3.5 million kids less than five, each year, it is a major issue. Its severity is still greatest in Sudan and western Kordufan, where it is public health problems. **Objectives:** Identification of risk factors and immediate contributors to malnutrition among kids less than five years old was the goals of the study. **Methodology:** The study's methodology was prospective descriptive. This study included all children under the age of five who were admitted to Al-Nohud Hospital and were diagnosed with unembellished critical malnutrition, which is identified as weight for height quantity of 70% of the median or > 3 SD below the mean World Health Organization situation values or the occurrence of consensual fighting oedema of nutritious origin. The World Health Organization arrangement of kids from 0-59 months of time for height (HFH -3 z-score, or Mid-Upper Arm Circumstances 115 mm) served as the foundation for this investigation. A large proportion of kids (66.7%) had a Mid-Upper Arm Circumstances of below 11cm (110mm), exhibiting acute malnourishment, and (28.6%) had a Mid-Upper Arm Circumstances of between 11 and 12cm, showing adequate malnourishment. According to interpretation of Mid-Upper Arm Circumstances in the research, Weight in relation to height, which represents the majority, is (-3SD). **Results:** Maternal illiteracy, mother's age, families' economic situation, exposure to infectious infections, and diarrhoea were all factors in under-five malnutrition. **Conclusion:** By educating mothers on the value of healthy eating for their children's growth and development, we can raise their level of education. All expectant mothers should get antenatal care, and existing programs on child care, infection control, and breastfeeding should be reinforced.

Keywords: Risk factor, Malnourishment, Under Nutrition, Stunting, Wasting

1. Introduction

One of the most important measures recommended by WHO to achieve health equity are kids malnourished measure. The term malnutrition generally describes under nutrition and over nutrition (Picbougom et al., 2023; Uthman, 2009). The most important anthropometric indicators used to measure malnutrition in the communities

less than 5 years, are stunting, wasting, underweight. Low weights reflect the relationship of height to age as well as weight to age, and it also reflects the accumulation of cases of acute nourishments. (Janevic et al., 2020).

The Millennium Development Goals (MDGs) state as the first goal “to halve between 1990 and 2015 the proportion of people who suffer from hunger” (Bliznashka et al., 2021) Various studies have proven that the problem of malnutrition is large, and that the groups most vulnerable to it are kids and women who suffer from the persistence of malnutrition related to malnourishment, for example food security.

Malnourishment is a severe issue since it kills 3.5 million kids less than 5 years, each year globally and ranks third in the world for the problem of disease in this group (Onis et al.,2008). Equal though babyhood malnourishment decreased somewhat internationally through the 1990s; its occurrence grew in Africa equal throughout that year. (Blössner et al., 2005). Around 143 million kids less than 5 years in the evolving world—more than 25% of all children—are malnourished. Nearly three-quarters of the 143 million undernourished kids living in just 10 Sub-Saharan African countries, and above 25% of kids less than 5 years are undernourished. (Huang & Yang, 2020).

When only nations with stunting prevalence rates of at least 20% were taken into account, thirty-six present nations calculated for 90% of all stunted kids worldwide (Pediatrics Week, 2017). Children in underdeveloped nations experience moderate severe undernourishment in about nine percent of sub-Saharan African children, 19% of South Asian children (State of the World's Children, 2012). And severe undernourishment in tow percent of kids (Onis et al.,2008). This equates to roughly 60 million children who are moderately acutely malnourished and 13 million who are severely acutely malnourished at any given time (Jamro et al., 2012).

Until now, malnutrition is considered a health problem that represents a major challenge to public health and development as a result, not alone in evolving populations, however likewise globally (Uthman, 2009). Formerly, kid's malnourishment continues to be problem for public health, primarily in progressing nations like Ethiopia (GUPTA et al., 1991).

The federal ministry of health for Sudan (2014) (Ahmed et al., 2020). Stated that Sudan's rate of childhood malnutrition has risen beyond the global average. One in 20 Sudanese children is severely starving, according to the deputy secretary of the ministry of health, who revealed that half a million kids in the country are distress from prolonged malnourishment. 12.6% of kids under the age of five continue to experience severe wasting and stunting due to malnutrition (International Food Policy Research Institute, 2014). Utilizing anthropometric measurements, often weight and length (or height), children's health is frequently assessed as an outcome of growth (Gebretsadik et al., 2021). Both in Sudan and the research area, child malnourishment is still a severe public health problem. Identifying the reasons for malnourishment is necessary to fighting it, which is exactly it was critical to identify the root causes of poor malnourished in kids of less than five years.

2. Method

Research was done in Al-nohoud town. It is capital of western kordufan state. We accompanied a community-built cross sectional research which was cast-off to measure the threat factors linked with severe acute malnutrition amongst 6-59 months' kids live in the area. Using Mid-Upper Arm Circumstances dimension, the kids were measured for their nourishing grade. Kids with strictly undernourished is with Mid-Upper Arm Circumstances <115 mm.

Research was done with a sample of normal household living in the research area. The study population of research was kids less than 5 years. For newborn and young child nourishing had alarmed to 6-23 months old.

The sample size was determined using formula that calculates the base of occurrence of 50% and design effect of 1.5.

$$n = DF * \frac{Z_{1-\alpha/2}^2 P(1-P)}{E^2} \text{ or } n = 1 + \rho(m-1) * \frac{Z_{1-\alpha/2}^2 P(1-P)}{E^2}$$

n = required minimum sample size

DF = design effect=1+ρ(m-1)

ρ = intracluster correlation

m = number of individual in each cluster

P = the estimated prevalence of an indicator

α = Level of significance

Z_α = the z-score corresponding to the degree of confidence

E = Desired Precision

Total section comprised 576 kids in study area. The selected specimen methods is systematic three phase clusters random selection, the first step concentrating on choosing neighborhoods with in topographical area of region of Al-Nole population of the chosen blocks was enrolled. As much as practicable, a comparable number of households within the unit (block) was chosen. Using the systemic random selection approach, the necessary number of households in each block was chosen. In every designated home, all kids less than 5 years involved in research even if they are from deferent mothers. Children aged less than 5 years not from selected home and refusal were not involved in the study.

Data were gathered via a survey. The survey that will be used to gather information from families was educated on by public health authorities and vaccination professionals.

The survey was initially written in Arabic, and then distributed by tow previously trained investigator. Everyone of volunteer was accompanied by district godmother to simplify the conversation. All mothers or caregivers of kids asked to reply to a questionnaire. The survey included questions about mothers' care, kid healthiness and care practices, social indicators, and socio-demographic and economic aspects and household statistics.

After training, the practical use of the processes and equipment was examined by administering a prior test to comparable eligible study children from the nearby census region. According to the outcome of the pre-test, the survey was revised.

Throughout the whole time of gathering data, the lead scientist and coordinators carried out strict site supervision. Before being handed over to the gatherers of data, completed surveys were carefully examined and cross-checked each day. Both the interview portion and the anthropometric measures were included in the questionnaire

A motorized infant suspending weight with a 15 g payload was used to assess body weight for kids who were unwilling to get up. But a Japanese-made motorized panel balance with a 130 kg capability was utilized for larger youngsters. All kids were measured twice and weighed to the nearest 0.1 kg in casual clothes and without footwear. Before and after the investigation began, the measuring instruments were accuracy-checked, and they were then frequently rechecked.

Height and length were meticulously restrained to the nearest 0.1 cm spending an inelastic determining tape. Children who were more than 24 months old and taller than 85 cm were restrained standing up, kids younger than one year of age or less than 85 cm tall were measured while lying on their beds.

Children's rulers were used to determine MUAC in centimeters, and results were accurate to within 0.1 cm. When the upper body rested, a reading was obtained on the leftward at the theme among the elbow and the shoulder.

Data were entered using Statistical Package for Social Sciences (SPSS) version 22 for analysis. Formerly recoded, characterized and arranged to simplify its examination. For ordinarily disseminated constant variable, standard deviation was associated using unpaired t-test. Descriptive analysis was used to define the proportions and amount

circulations of the sample size by socio-demographic features and other related variables in the research. Differences in proportions were compared by using Chi-square test. A possibility of less than 0.05 was measured statistically significant. The power of relationship of selected associated/risk factors for acute malnutrition was determined by assessing odds ratios (ORs) and their 95% confidence intervals (CIs).

Agreement was gained from the individual parent previous to the survey.

3. Results

Table 1: Socio-demographic Characteristics of children assessed for malnutrition from Alnohoud locality (N=768)

Demographic characteristics	Response category	No	%
Age of children	less than 12 month	221	28.8
	12-24 month	469	61.1
	25-36 month	48	6.3
	37-48 month	12	1.6
	49-59 month	18	2.3
sex of children	male	406	52.9
	female	362	47.1
age of mothers	= 25	311	40.5
	26-30 years	323	42.1
	31-35 years	67	8.7
	=36	67	8.7
social status	Married	616	80.2
	separate	95	12.4
	widow	57	7.4
Mothers educational level	illiterate	122	15.9
	primary school	251	32.7
	secondary and high school	246	32.0
	university	126	16.4
	post graduate	23	3.0
maternal occupation	farmer	166	21.6
	laborer	54	7.0
	Employee	157	20.4
	house wives	391	51.0
Monthly family income	= 2000	474	61.7
	2001-5000 SP	233	30.3
	= 5000 SP	61	7.9

A number of 768 mothers of children who were selected as a sample were included in the study for analysis. The study proved, as shown in the table, that the average age of the children was 1.87 (0.78%) months. More than 400 children are male (52.9%). The study also showed that the majority of mothers participating in the study, 616 (80.2%), were married. Regarding the educational level, the study showed that more than half of the mothers had low education (64.7%) and that half of them were housewives (51%). The study showed that nearly two-thirds of the participants had a low level of income.

Table 2: Environmental health conditions which are factors under five children age Malnutrition in Alnohoud locality, n=768.

Risk factors	Response category	No	%
Washing hands	Before feeding the baby	314	40.9
	before breast feeding	234	30.5
	after cleaning baby's bottom	145	18.9
	before food preparation	75	9.8
Waste disposal	pit latrine	479	62.4
	improved pit latrine	224	29.2
	septic tank	30	3.9
	No facility/bush/field	35	4.6
sources of drinking water	deep well	278	36.2
	public network	360	46.9
	Rain water	74	9.6
	Surface water	56	7.3
Means of water transmission	Jericans	308	40.1
	tankers	293	38.2
	Carriages	167	21.8
Numbers of meals during a day	Two meals	117	15.2
	three meals	523	68.1
	more than three meals	128	16.7

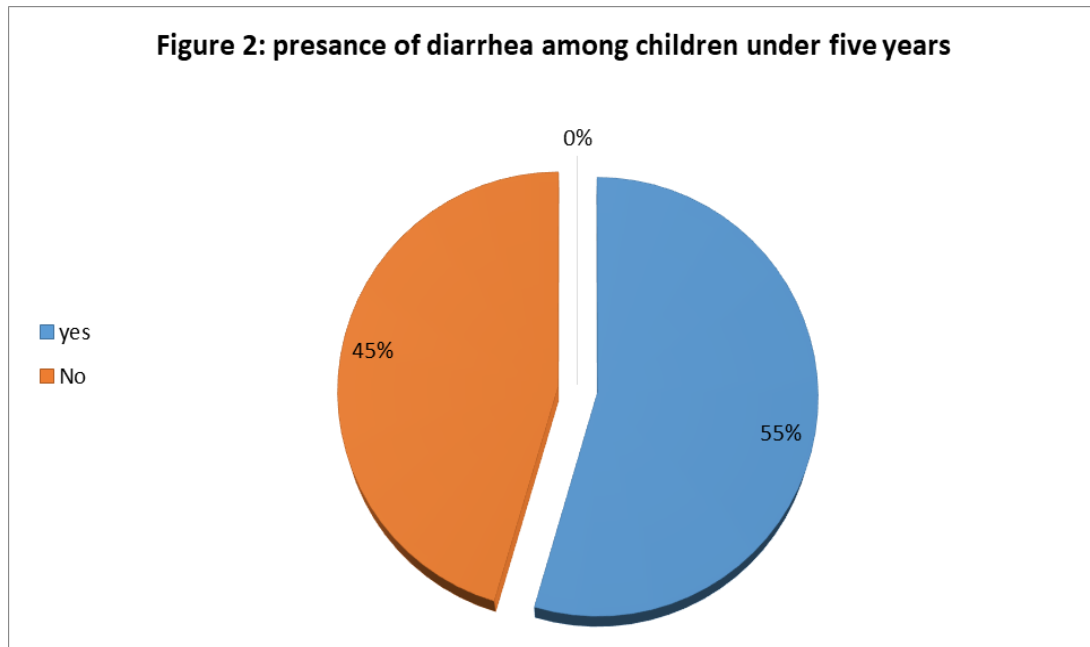
Concerning environmental and behavioral risks, the study showed that mothers' behavior regarding personal hygiene (washing hands with soap and water before feeding children) was poor, which had a negative impact on the children's health.

The study also proved that more than 60% of the study samples habit pit baths to dispose of human discarded, which makes the environment susceptible to the breeding of disease vectors. Our study showed that the tools used to bring drinking water are primitive, lack hygiene, and do not guarantee the safety of drinking water, especially since the main source of water is the public network and underground wells.

Table 3: Factors associated with malnutrition among children less than five years' age in Alnohoud locality.

Demographic characters	category	Malnutrition category				X2	p-v
		wasting No (%)	stunting No (%)	Underweight No (%)	Total No (%)		
Age of mothers	= 25	40(5.2)	31(4.0)	38(4.9)	109(14.2)	57.40	.000
	26-30 years	63(8.2)	55(7.5)	66(8.6)	184(24.0)		
	31-35 years	12(1.6)	7(0.9)	11(1.4)	30(3.9)		
	= 36	20(2.6)	11(1.4)	13(1.7)	44(5.7)		
	Total	135(17.6)	104(13.5)	128(16.7)	367(47.8)		
Education of mothers	Illiterate	22(2.9)	14(1.8)	15(2.0)	51(6.6)	41.00	.004
	primary school	40(5.2)	34(4.4)	36(4.7)	110(14.3)		
	secondary and high school	46(6.0)	38(4.9)	49(6.4)	133(17.3)		
	university	26(3.4)	10(1.3)	21(2.7)	57(7.4)		
	post graduate	1(.2)	8(1.0)	7(0.9)	16(2.1)		
	Total	135(17.6)	104(13.5)	128(16.7)	367(47.8)		
Family income size	= 2000	72(9.4)	57(7.4)	71(9.2)	200(26.0)	32.74	.000
	2001-5000 SP	50(6.5)	39(5.1)	51(6.6)	140(18.2)		
	> 5010 SP	13(1.7)	8(1.0)	6(0.8)	27(3.5)		
	Total	135(17.6)	104(13.5)	128(16.7)	367(47.8)		

The factors associated with acute malnutrition were: mother's ages (p -value = 0.000), which concenter strongly significant association, mother's educational levels (p -value = 0.004), and family's income (p -value = 0.000). The study showed that the children of mothers whose children are less than 30 years old are more likely to suffer from malnutrition than the children of mothers who are in the age groups above 30 years old, our research found that families with fewer resources (2000) had a higher likelihood of malnutrition.



The number of kids who said they had diarrhea in the three weeks before the discussion served as the numerator, and the total figure of kids in the sample served as the denominator, to estimate the occurrence of diarrhea between kids less than 5 years. The prevalence of diarrheal cases over the three weeks before to the interview was 55% overall.

Table 4: Socio-demographic Characteristics of children associated with nutritional status, Alnohoud locality, (N=768)

Demographic characteristics	Response category	Nutritional status			Total	p-v	X ²
		Acute malnutrition (No/%)	Moderate malnutrition (No/%)	Well nourished (No/%)			
Age of children	less than 12 month	38(4.9)	145(18.9)	38(4.9)	221(28.8)	48.38	.000
	12-24 month	146(19.0)	232(30.2)	91(11.8)	469(61.0)		
	25-36 month	3(0.4)	32(4.2)	13(1.5)	48(6.3)		
	37-48 month	0(0.00)	8(1.1)	4(0.5)	12(1.6)		
	49-59 month	2(0.3)	6(0.8)	10(1.3)	18(2.3)		
	Total	186(24.6)	423(55.1)	156(20.3)	768(100)		
sex of children	male	86(11.2)	225(29.3)	95(12.4)	406(52.9)	8.17	.017
	female	103(13.4)	198(25.8)	61(7.9)	362(47.1)		
	Total	189(24.6)	423(55.1)	156(20.3)	768(100)		
age of mothers	= 25	52(6.8)	180(23.4)	79(10.3)	311(40.5)	42.81	.000
	26-30 years	114(14.8)	158(20.6)	51(6.6)	323(42.1)		
	31-35 years	6(0.8)	48(6.2)	13(1.5)	67(8.7)		
	=36	17(2.2)	37(4.8)	13(1.5)	67(8.7)		
	Total	189(24.6)	423(55.1)	156(20.3)	768(100)		
social status	Marred	169(22.0)	346(45.1)	101(13.2)	616(80.2)	47.18	.000
	separate	10(1.3)	42(5.5)	43(5.6)	95(12.4)		
	widow	10(1.3)	35(4.6)	12(1.6)	57(7.4)		
	Total	189(24.6)	423(55.1)	156(20.3)	768(100)		
Mothers educational level	illiterate	28(3.6)	71(9.2)	23(3.0)	122(15.9)	25.95	.001
	primary school	43(5.6)	146(19.0)	62(8.1)	251(32.7)		
	secondary and high school	78(10.2)	133(17.3)	35(4.6)	246(32.0)		
	university	38(4.9)	58(7.6)	30(3.9)	126(16.4)		
	Total	189(24.6)	423(55.1)	156(20.3)	768(100)		
maternal occupation	farmer	46(6.0)	96(12.5)	24(3.1)	166(21.6)	8.19	.415
	laborer	12(1.6)	28(3.6)	14(1.8)	54(7.0)		
	Employee	32(4.2)	91(11.8)	34(4.4)	157(20.4)		
	house wives	99(13.0)	208(27.1)	84(10.9)	391(51.0)		
	Total	189(24.6)	423(55.1)	156(20.3)	768(100)		
Monthly family income	= 2000	103(13.4)	268(34.9)	103(13.4)	474(61.1)	7.17	.127
	2001-5000 SP	68(8.9)	126(16.4)	39(5.1)	233(30.3)		
	= 5000 SP	18(2.3)	29(3.8)	14(1.8)	61(7.9)		
	Total	189(24.6)	423(55.1)	156(20.3)	768		

A sociodemographic factor associated with nutritional Status were: age of children (p-value = 0.000), age of children (p-value = 0.000), Mothers educational levels, (p- value = 0.001), which concenter strongly significant association, our study revealed no correlation amongst nourishing Grade and sex of kids, (p-value= 0.017), maternal occupational (p- value =0.415) and families' income (p-value =0.127).

4. Discussion

There is once again a need to look into the contributions of many factors impacting malnutrition in order to properly address the issues with under-five malnutrition in Sudan generally and in the current research areas in particular. In order to incorporate as many risk variables as feasible, this study has attempted to examine the elements that contribute to malnutrition in the study area.

Kids younger than 12 months were shown to be more probable to be underweight throughout the research time. This conclusion is reinforced by research conducted in Ethiopia using the EDHS report. (Gelana et al., 2017. Hailemariam et al., 2017) was in conflict with a 2009 study done in Kenya (Gelana, 2014. Talukder, 2017).

Our research found a strong correlation between maternal illiteracy and a child's chance of developing malnourished before the age of five. The same results were made in Machakel Woreda, Northwest Ethiopia, and North Gondar, where the risk of developing hunger raises threefold and above (Gebretsadik et al., 2023) However, we identified larger magnitudes of stunted growth, which may be due to survey site variance.

The findings of this research demonstrated that maternal education had an important beneficial effect on kids stunted growth; children whose parents had secondary or higher education were about 32–50% less likely to continue to be in the most severe nutritional conditions than children whose parents had no formal education. This result is in agreement with a number of earlier research (Nahar et al., 2010. Musa et al., 2017. Jeyaseelan et al., 1997. Lenka, 2015). Similar studies show that the children's nutritional status was influenced by the mother's literacy. Kids of uneducated moms were more likely to be underweight, stunted, or wasteful. Malnourished in kids less than 5 years was highly correlated with mothers' lack of education indicating that one way to intervene to lower child malnutrition might be to increase mothers' education or literacy. (Dube et al., 2014. Khor et al., 2003. Hong, 2007. Tette et al., 2015. Chirande et al., 2015. Zhang et al., 2011).

Our research showed the connection between malnutrition and a monthly household income of 2000 pence (about 25 dollars) and the significance of poverty in the etiology of malnutrition in this context. This is comparable to earlier research from Khartoum and Northern Sudan that revealed that the income of low-income families was a hazard feature for unembellished critical malnourishment. Another Ghanaian research indicated that persistent undernutrition is closely related to economic inequality (Yisak et al., 2015) It is also comparable to a study conducted in Nigeria, which discovered that malnutrition was linked to mother monthly income of \$20 and monthly household food spending of \$55 (Johri et al., 2016. Heidkamp et al., 2015).

Our research discovered, the practice of undefended basis of consumption water improved the danger of malnourishment triple and beyond than threatened water foundation. The population in the desert does not have access to pure and safe drinking water, and we find that the main environmental risk factors that lead to the spread of common diseases are unsanitary practices. Percentages of Sudanese who have insufficient access to clean water in rural, town, and national settings are 21%, 84%, and 30%, respectively (Nassur et al., 2022) The occurrence of water borne disorders like diarrhea, which subsidize to malnourishment, is intimately associated to admission issues and unprotected potable drinking water (Gudu et al., 2020).

Lack of food is three times more common among mothers who neglect hand soaping at every opportunity than in child care providers or mothers who just wash their hands after using the restroom. According to our research, more than forty of mothers cleansed fingers before feeding kids. In Sudan, an identical result was made. When a kid is six months old, extra nourishment is crucial, but inadequate eating habits can also be detrimental to the nutritional well-being of young infants. Advanced occurrence of malnourishment (94.2%) detected in kids of mothers didn't practice hand hygiene after conduct garbage. It is important to wash hands well after touching any surfaces or doing any activates, and then dealing with kids. For health practitioners, practice of hand hygiene is important to break the connection between food and the spread of infection. health practitioners need to clean their hands with soap and water before preparing food, before feeding children, and after visiting the toilets or cleaning kid's stools (Gewa, 2010. Menalu et al., 2021. Tekile et al., 2019. Anonymous, 2016. Sambo et al., 2022).

5. Conclusions

Severe Acute Malnutrition is establishing to be related with low Mothers' educational level, age of mother, families' economic status, exposure to infectious diseases and diarrhea.

In this research, Mid-Upper Arm Circumstances, founded to be a great broadcast method. Thus, it is preferable to measure the mid-upper arm circumference periodically as part of the medical evaluation for all children who are

admitted to treatment hospitals and health centers to see a doctor and for different age groups. Priority must be given to interventions that limit the spread of malnutrition diseases and control the factors that help in the spread of malnutrition.

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References

- Ahmed, H.M.M., Elkarib, H.A.O., and Digna, M.F.M.O. (2020). "Survival status and determinants of under-five mortality in Sudan: Evidence from the Multiple Indicator Cluster Survey 2014," *Journal of health and Social Sciences*, Vol. 5, No. 3, pp. 369-386.
- Anonymous "Investigators at Taipei Medical University Have Reported New Data on Malnutrition. (2017). (Factors associated with malnutrition among children 5 years old in Burkina Faso: evidence from the Demographic and Health Surveys IV 2010)," *Pediatrics Week*, pp. 231.
- Anonymous "State of the World's Children, (2012). Children in an Urban World (TABLE 2); 2012 IIS 4020-S2.1,"
- Anonymous (2016). "Risk Factors of Malnutrition among Children under Five Year of Age in Mohamed Alamin Paediatric Hospital," *International Journal of Science and Research (IJSR)*, Vol. 5, No. 2, pp. 1995-1998.
- Bliznashka, L., Blakstad, M.M., Berhane, Y. (2021). "Household-level double burden of malnutrition in ethiopia: a comparison of Addis Ababa and the rural district of Kersa," *Public Health Nutrition*, Vol. 24, No. 18, pp. 6354-6368.
- Blossner, M., De Onis, M., and Prüss-Üstün, A. (2005). "Malnutrition: quantifying the health impact at national and local levels / Monika Blössner and Mercedes de Onis,,"
- Chirande, L., Charwe, D., Mbwana, H. (2015). "Determinants of stunting and severe stunting among under-fives in Tanzania: evidence from the 2010 cross-sectional household survey," *BMC Pediatrics*, Vol. 15, No. 1, pp. 165.
- Dube, G. B., W, B., and J, Debre Markos University, College of Medicine and Health Science, department of Public Health, P.O. Box: 269 Debre Markos, Ethiopia. (2014). "Assessment of Factors associated with Malnutrition among Under Five Years Age Children at Machakel Woreda, Northwest ethiopia: A Case Control Study," *Journal of Nutrition & Food Sciences*, Vol. 4, No. 1, pp. 1-8. early Childhood Nutritional Status in India," *The Journal of Nutrition*, Vol. 146, No. 7 , pp. 1402-1410
- Gebretsadik, G.G., Abraha, M., Bereket, T. (2023). "Prevalence and multi-level factors associated with acute malnutrition among children aged 6-59 months from war affected communities of Tigray, Northern ethiopia, 2021: a cross-sectional study," *Conflict and Health*, Vol. 17, No. 1, pp. 10.
- Gelana, G. (2014). "Assessment of Risk Factors Associated with Severe Acute Malnutrition among children Admitted to Addis Ababa Governmental Hospitals, Ethiopia,
- Gelana, G., Dessalegn, B., and Alemu, G. (2017). "Assessment of Breast Feeding Practice and Risk Factors Associated with Severe Acute Malnutrition among Children Admitted to Addis Ababa governmental Hospitals, Ethiopia, 2014: A Cross-Sectional Facility Based Study," *Open Access Journal of Science and Technology*, Vol. 5, No. 2,
- Gewa, C.A. (2010). "Childhood overweight and obesity among Kenyan pre-school children: association with maternal and early child nutritional factors—Erratum," *Public Health Nutrition*, Vol. 13, No. 1, pp. 146.
- Gudu, E., Obonyo, M., Omballa, V. (2020). "Factors associated with malnutrition in children < 5 years in western Kenya: a hospital-based unmatched case control study," *BMC Nutrition*, Vol. 6, No. 1, pp. 33.
- Gupta, M.C., Manjusha, M, S. (1991). "Relation of childhood malnutrition to parental education and mothers' nutrition related KAP," *Indian Journal of Pediatrics*, Vol. 58, No. 2, pp. 269-274.
- Hailemariam, T., Gebregiorgis, A., Meshesha, M. (2017). "Application of Data Mining to Predict the likelihood of Contraceptive Method Use among Women Aged 15-49 Case of 2005 Demographic Health survey Data Collected by Central Statistics Agency, Addis Ababa, Ethiopia," *Journal of Health & Medical Informatics*, Vol. 8, No. 3,

- Heidkamp, R.A., Ayoya, M.A., Teta, I.N. (2015). "Complementary feeding practices and child growth outcomes in Haiti: an analysis of data from Demographic and Health Surveys," *Maternal and Child Nutrition*, Vol. 11, No. 4, pp. 815-828.
- Hong, R. (2007). "Effect of economic inequality on chronic childhood undernutrition in Ghana," *Public Health Nutrition*, Vol. 10, No. 4, pp. 371-378.
- Huang, X., Yang, B., Liu, Q. (2020). "Improving maternal and child nutrition in China: an analysis of nutrition policies and programs initiated during the 2000–2015 Millennium Development goals era and implications for achieving the Sustainable Development Goals," *Journal of Health, Population and Nutrition*, Vol. 39, No. 1, pp. 12.
- International Food Policy Research Institute, (2014). "Nutrition country profile indicators: Definitions and sources,"
- Jamro, B., Junejo, A., Lal, S. (2012). "Risk Factors for Severe Acute Malnutrition in Children
- Janevic, T., Petrovic, O., Bjelic, I. (2010). "Risk factors for childhood malnutrition in Roma settlements in Serbia," *BMC Public Health*, Vol. 10, No. 1, pp. 509.
- Jeyaseelan, L., and Lakshman, M. (1997). "Risk Factors For Malnutrition In South Indian children," *Journal of Biosocial Science*, Vol. 29, No. 1, pp. 93-100.
- Johri, M., Subramanian, S.V., Koné, G.K. (2016). "Maternal Health Literacy Is Associated with Early Childhood Nutritional Status in India," *The Journal of Nutrition*, Vol. 146, No. 7, pp. 1402-1410
- Khor, G.L., and Sharif, Z.M. (2003). "Dual forms of malnutrition in the same households in Malaysia--a case study among Malay rural households," *Asia Pacific Journal of Clinical Nutrition*, Vol. 12, No. 4, pp. 427-437.
- Lenka, C. (2015). "Influence of environmental factors, parental attributes and feeding practices on prevalence of severely acute malnutrition among children," *Food Science Research Journal*, Vol. 6, No. 2, pp. 404-408.
- Menalu, M.M., Bayleyegn, A.D., Tizazu, M.A. (2021). "Assessment of Prevalence and Factors Associated with Malnutrition Among Under-Five Children in Debre Berhan Town, Ethiopia," *International Journal of General Medicine*, Vol. 14, pp. 1683-1697.
- Musa, M.K., Muhammad, F., Lawal, K.M. (2017). "Risk Factors of Severe Acute Malnutrition among under-five Children: A Hospital-based Study in Bangladesh," *Journal of Medical Sciences and health*, Vol. 3, No. 3, pp. 13-21.
- Nahar, B., Ahmed, T., Brown, K.H. (2010). "Risk factors associated with severe underweight among young children reporting to a diarrhea treatment facility in Bangladesh," *Journal of Health, Population and Nutrition*, Vol. 28, No. 5, pp. 476-483.
- Nassur, A., Daanouni, O., Luc, G. (2022). "Factors associated with acute malnutrition among children aged 6-59 months in Haiti, Burkina Faso and Madagascar: A pooled analysis," *PloS One*, Vol. 17, No. 12, pp. e0278980.
- Onis, M., Ezzati, M., Mathers, C. (2008). "Maternal and Child Undernutrition 1: Maternal and child undernutrition: global and regional exposures and health consequences," *The Lancet (British edition)*, Vol. 371, No. 9608, pp. 243.
- Picbougoum, T.B., Somda, M.A.S., Zango, S.H. (2023). "Nutritional status of children under five years and associated factors in 24 districts of Burkina Faso," *PLOS Global Public health*, Vol. 3, No. 7, pp. e0001248.
- Sambo, J., Cassocera, M., Chissaque, A. (2022). "Characterizing Undernourished Children Under-Five years Old with Diarrhoea in Mozambique: A Hospital Based Cross-Sectional Study, 2015–2019,"
- Talukder, A. (2017). "Factors Associated with Malnutrition among Under-Five Children: Illustration using Bangladesh Demographic and Health Survey, 2014 Data," *Children (Basel)*, Vol. 4, No. 10, pp. 88.
- Tekile, A.K., Woya, A.A., and Basha, G.W. (2019). "Prevalence of malnutrition and associated factors among under-five children in Ethiopia: evidence from the 2016 Ethiopia Demographic and Health survey," *BMC Research Notes*, Vol. 12, No. 1, pp. 391.
- Tette, E.M.A., Sifah, E.K., and Nartey, E.T. (2015). "Factors affecting malnutrition in children and the uptake of interventions to prevent the condition," *BMC Pediatrics*, Vol. 15, No. 189, pp. 189
- under the Age of Five Year in Sukkur," *Pakistan Journal of Medical Research*, Vol. 51, No. 4, pp. 111.
- Uthman, O.A. (2009). "Using extended concentration and achievement indices to study socioeconomic inequality in chronic childhood malnutrition: the case of Nigeria," *International Journal for Equity in health*, Vol. 8, pp. 1-8.
- Yisak, H., Gobena, T., and Mesfin, F. (2015). "Prevalence and risk factors for under nutrition among children under five at Haramaya district, Eastern Ethiopia," *BMC Pediatrics*, Vol. 15, No. 213, pp. 212.
- Zhang, J., Shi, J., Himes, J.H. (2011). "Undernutrition Status of Children Under 5 Years in Chinese Rural Areas-Data from the National Rural Children Growth Standard Survey, 2006," *Asia Pacific Journal of clinical Nutrition*, Vol. 20, No. 4, pp. 584-592.