


Alarming high malnutrition in childhood and its associated factors

A study among children under 5 in Yemen

Khaled Al-zangabila, MPH^a, Sasmita Poudel Adhikari, MPH^a, Qingzhi Wang, MPH^a, Thankam S. Sunil, PhD^{a,b}, Scott Rozelle, PhD^c, Huan Zhou, PhD^{a,*} 

Abstract

Childhood malnutrition is a serious public health problem in Yemen. However, there is a limited information regarding association of malnutrition with different socio-economic factors. This study examines the correlates of socioeconomic and maternal behavioral factors on malnutrition in Yemeni children under 5 years of age.

Our study focuses on the nutritional status of children under 5 years of age, and uses the data provided by the cross-sectional study namely Yemen National Demographic and Health Survey. Three anthropometric indicators: stunting, wasting, and underweight were selected for the evaluation of malnutrition. Independent variables include personal and maternal characteristics, socioeconomic and behavioral factors, and illness conditions. The study used the Chi-Squared test to test the significant association between independent variables and logistic regression to estimate the odds of being malnourished.

A total of 13,624 Yemeni children under 5 years of age were included in the study. The results show the high malnutrition level – the prevalence of stunting was 47%, wasting was 16%, and underweight was 39%. There is a statistically significant association between socioeconomic status, behavioral factors, and child malnutrition. The odds of malnutrition decreased with the increase in the level of mother's education, economic status, and frequency of prenatal visits. The odds of malnutrition were least for children whose mothers had highest level of education (OR=0.64; 95%CI=0.55–0.76), who belonged to highest wealth index (OR=0.41; 95%CI=0.36–0.47). Moreover, the likelihood of malnutrition was less among the children whose mother had highest number of prenatal visits during the pregnancy (OR=0.67; 95%CI=0.59–0.76).

The high prevalence of stunting, wasting, and undernutrition were found in Yemeni children. Different factors such as regional variations, socio-economic disparities, and maternal education and health care utilization behavior are found to be associated with high malnutrition. These findings provide important policy implications to improving childhood malnutrition in Yemen.

Abbreviations: HAZ = height-for-age, LMIC = Low and middle- income countries, OR = odds ratio, UNICEF = United Nations Children's Fund, WAZ = weight-for- age, WHA = World Health Assembly, WHO = World Health Organization, WHZ = weight-for-height, YNDHS = Yemen National Demographic and Health Surveys.

Keywords: children, malnutrition, maternal behavior, socio-economic status, Yemen

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^a West China School of Public Health and West China Fourth Hospital, Sichuan University, Chengdu, China, ^b Department of Public Health, University of Tennessee, Knoxville, ^c Freeman Spogli Institute for International Studies, Stanford University, California.

* Correspondence: Huan Zhou, West China School of Public Health and West China Fourth Hospital, Sichuan University, Chengdu, Sichuan, China (e-mail: zhouhuan@scu.edu.cn).

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1. Introduction

In low and middle-income countries (LMICs), childhood malnutrition poses a major public health problem, particularly as it relates to child growth and development. Malnutrition refers to the imbalance of energy either due to insufficient or excess intake of energy in a person^[1] and is associated with long-term physical and mental health problems.^[1,2] The World Health Assembly has proposed a millennium core development goal of “eliminating all forms of malnutrition by 2030”.^[3] To this end, the United Nations Children's Fund (UNICEF) and the World Health Organization (WHO) have taken various measures to monitor the rates of malnutrition and promote the improvement of the nutritional health of both children and adults in low-and-middle-income around the world.^[2–4]

Malnutrition in children is commonly measured using the indicators: stunting, wasting, and underweight– issues that remain prominent in LMICs including Yemen.^[3] Stunting (height-for-age) refers to cumulative growth deficits and is an indicator of chronic malnutrition; wasting (low-weight-for-height) is an indicator of acute weight loss; and underweight (low-weight-for-age) is a composite indicator which can reflect wasting, stunting, or both.^[5] Globally, malnutrition in children under-5 years of age still remains prominent with 21% stunted

and 7% wasted in 2019.^[4] There have been marked improvements in malnutrition rates over the past few decades. Worldwide, the prevalence of stunting in children less than 5 years old declined from 40% in 1990 to 21% in 2019.^[3] In Yemen, the prevalence of stunting decreased from 55% in 1997 to 46% in 2011, of which 23% were severely stunted. The percentage of underweight children decreased from 46% in 1997 to 39% in 2011, of which 14% were severely underweight. Similarly, the percentage of wasted children decreased from 16% in 1997 to 13% in 2011, of which 5% were severely wasted. Despite these improvements, Yemeni children still suffer from severe malnourishment.^[6] This alarmingly high prevalence of malnutrition in Yemen is attributed to political instability, conflicts, and poverty.^[7,8]

Many studies have reported the importance of socio-economic factors, maternal behavior, education, and healthcare utilization in determining the prevalence of childhood malnutrition in LMICs.^[9–12] In addition, previous research has also found maternal risk-taking behaviors and disease features^[11,13,14] as important variables for understanding changes in children's nutritional levels. However, in the context of Yemen detailed subgroup analysis for childhood nutrition is limited. Hence, it is important to understand the prevalence of childhood malnutrition in different groups to formulate relevant and targeted nutritional programs.

In Yemen, political instability and ongoing war has made it difficult to obtain data on malnutrition and as a result, very few studies have been conducted to assess the nutritional status of children.^[15] The conflict has disrupted the country economy, social services, health systems, food insecurity, and developmental progress. This has resulted in exacerbating the health problems and malnutrition in the children and entire population.^[7,8,16] Data collection has become very difficult and merely impossible since the war has divided the country between rebel-controlled regions and government-controlled regions.^[15] Therefore, we used a data from latest nationally available survey conducted at 2013.

The goal of this paper is to explore the prevalence of malnutrition and its association with other factors. To achieve this goal, we have 2 objectives. First, to analyze the prevalence of malnutrition in Yemeni children under the age of 5 (in terms of stunting, wasting, and underweight). Second, to explore the relationships between socioeconomic and behavioral factors on childhood malnutrition in Yemen. The results of this analysis will better inform program designers and policymakers, enabling them to create and improve inter-sectoral health and nutritional programs.

2. Materials and methods

2.1. Study design and population

The present study is the secondary analysis of data that comes from the latest Yemen National Demographic and Health Surveys (YNDHS) conducted in 2013.^[6] YNDHS is a nationally representative, cross-sectional survey which provides population and health indicator estimates at the national and regional levels. The sample for the 2013 YNDHS was selected by a stratified two-stage cluster sampling methodology which consisted of 800 clusters (213 urban clusters and 587 rural clusters). According to this sampling methodology, the clusters are identified and respondents within the clusters are randomly chosen. Details

about the sampling design and data collection procedures can be obtained from the YNDHS report.^[6] A total of 17,351 households were interviewed, yielding a 96.3% response rate—16,656 married women aged 15 to 49 were included in the survey. This study included 13,624 children under 5 years of age for the analysis of malnutrition indicators. The ethical approval process for further analysis and publication was exempted for this study since it was based on secondary data and original research did not violate any ethics procedure. Datasets were accessed through demographic and health survey program upon the written request with explanation of purpose of study.

2.2. Study variables

The dependent variables used in the study are stunting, wasting, and underweight, which are derived through anthropometric measurements of weight, height, and age. These indicators are recommended by WHO for measuring the malnutrition of children in any given society in the short and long term.^[17] Z-scores of children with height-for-age (HAZ), weight-for-age (WAZ), and weight-for-height (WHZ) less than -2 standard deviations (SD) of the WHO reference population were defined as stunted, underweight, and/or wasted, respectively.^[17]

The independent variables used for analysis include the region of residence (coastal, mountainous, plateau), place of residence (urban, rural), age of child (in months), sex of child, illness conditions (has a fever or has diarrhea within 2 weeks preceding survey), age of mother, mother's education level (literate or low; primary; preparatory; secondary and above), wealth index (low, medium and high), and health care utilization for prenatal care (in terms of visits to health facilities categorized as 0 time, 0-3 times and 4+ times). All the categories in this study for each independent variable were used as categorized in YNDHS.^[6]

2.3. Statistical analysis

Descriptive and logistic regression analyses were conducted for data analysis. At first, independent variables were described with percentages and Chi-Squared tests were used to test the statistical significance between independent variables. Then, variables that showed the statistical significance at the level of $P < .05$ were included in logistic regression analyses. Logistic regression was used to estimate the odds of being malnourished. All analyses were done using Stata 15.0 (StataCorp, College Station, TX, United States).

3. Results

3.1. Socioeconomic and demographic characteristics of participants

The basic socioeconomic and demographic characteristics of study participants are reported in Table 1. Among the participants, the majority (67.22%) were from mountainous regions, maximum (77.06%) lived in rural areas, and the proportion of children aged 1 to 5 was evenly (20%) in each age subgroups, and there was equal percentage of male and female (50%). Most of the children had a fever (67.78%) and diarrhea (62.23%) within in 2 weeks preceding the survey. The mothers of the sampled children were mainly in the age group of 20 to 29 years old (52.31%). More than half (55.60%) of the mothers were literate or had low level of education. 44.46% of the children belonged to a family with low wealth index, and 26.20% of the mothers did not have a prenatal

Table 1
Summary statistics of sample children in Yemen 2013 (N = 13,624).

Characteristics	Frequency (n)	Percentage (%)
Region		
Coastal	2167	15.91
Mountainous	9158	67.22
Plateau	2299	16.87
Place of residence		
Urban	3126	22.94
Rural	10,498	77.06
Age (Month)		
0–5	1424	10.45
6–11	1376	10.10
12–23	2765	20.30
24–35	2723	19.99
36–47	2650	19.45
48–59	2686	19.72
Sex of child		
Male	6915	50.76
Female	6709	49.24
Has Fever		
Yes	9235	67.78
No	4349	31.92
Missing	40	0.29
Had diarrhea recently		
Yes	9296	68.23
No	4276	31.39
Missing	52	0.38
Age of mother		
<20	505	3.71
20–29 years	7127	52.31
>30	5992	43.98
Mother's education level		
Literate or low	7575	55.60
Primary	1168	8.57
Preparatory	3245	23.82
Secondary and above	1636	12.01
Wealth Index		
Low	6057	44.46
Medium	2915	21.40
High	4652	34.15
Number of prenatal visits		
0	3569	26.20
1–3 times	3195	23.45
4+	2197	16.13
Stunting		
Yes	6272	46.04
No	7352	53.96
Wasting		
Yes	2190	16.07
No	11,434	83.93
Underweight		
Yes	5142	37.74
No	8482	62.26

Wealth index was developed by using a principal component analysis to combine information on the household's ownership of different assets or access to substantial goods. It has 3 categories (low, medium, and high).

visit during her pregnancy. Moreover, the national prevalence of stunting, wasting, and underweight was found to be 46.04, 16.07%, and 37.74% respectively.

3.2. Nutrition status by different characteristics

Table 2 lists the distribution in the percentage of children under 5 years of age who are stunted, wasted, and underweight based on

selected socioeconomic and behavioral characteristics. All indicators indicate that the level of malnutrition in Yemen is worse. Mountainous (50.58%) and rural areas (49.67%) have higher levels of chronic malnutrition (or stunting). However, children in coastal areas have higher levels of acute malnutrition (or wasting) than in other areas of the state. Underweight was high in coastal and mountain regions (39%) compared to the plateau region. Stunting and underweight was found to increase with the increasing age of the child. All malnutrition indicators showed that, overall, the proportion of malnourished children decreases with the increase in the educational level of the mother, the number of prenatal visits and improvements in the socioeconomic status.

3.3. Multivariate logistic regression

Table 3 shows the results of the logistic regression analysis based on our 3 indicators of malnutrition. The dependent variables are coded 1 if the Z-score is below -2SD and the dependent variable is coded as 0 when the Z-score is greater than or equal to -2SD for all 3 indicators (stunting, wasting, and underweight). In other words, if the child is malnourished, the value of the variable is 1; otherwise, it is 0.

3.3.1. Stunting. It was found that most of the variables used in the model were statistically significant. Children residing in mountainous region had a higher odds ratio (OR) = 1.55; [$P < .05$; 95%CI=1.36–1.77] of being stunted compared to children in other regions. The chances of stunting increased with the increase in the child's age. Illness conditions such as the recent incidence of fever or diarrhea (within last 2 weeks preceding survey) were found to be linked with stunting. Results showed that children with recent diarrhea were more likely to be stunted than those who did not have diarrhea (OR = 1.14; $P < .05$; 95% CI=1.02–1.26); findings were similar for children with recent fever (OR = 1.03; $P < .05$; 95%CI=0.93–1.14). Moreover, socioeconomic status was found to be statistically significant in explaining the odds of children being stunted. The odds of stunting increased with a decrease in increase in wealth index. The odds of stunting were reduced to 0.41 ($P < .0001$; 95%CI=0.36–0.47) times in children with high wealth index compared to the odds of 0.66 ($P < .001$; 95%CI=0.59–0.75) times in the children in the medium wealth index. Similarly, the odds of stunting decreased with the increase in the mother's education. Children whose mothers had an education level of secondary and above has the least odds of being stunted (OR=0.64; $P < .001$; 95%CI=0.55–0.76).

3.3.2. Wasting. The odds of being wasted, the odds were highest in the plateau region (OR=0.71; $P < .05$; 95% CI=0.59–0.85) compared to the coastal region. The odds of wasting were lower in urban areas when compared to the rural areas (OR=0.84; $P < .05$; 95% CI=0.71–0.99). Similarly, children with recent illness conditions such as fever (OR = 1.19; $P < .05$; 95% CI=1.05–1.35) or diarrhea (OR = 1.22; $P < .05$; 95% CI=1.08–1.38) have higher odds of children being wasted than healthier children. Children whose mothers had a high education level had comparatively less wasted. Moreover, the odds of wasting decreased with an increase in wealth index. The odds of wasting were reduced to 0.78 ($P < .001$; 95%CI=0.66–0.93) times in children with high wealth index compared to the odds of 0.88 ($P < .001$; 95%CI=0.76–1.02) times in the children in the

Table 2
Percentage distribution of nutritional status of children by different characteristics (Yemen 2013).

Characteristics	Stunting		Wasting		Underweight		Sample n
	n (%)	χ^2	n (%)	χ^2	n (%)	χ^2	
Region							
Coastal	790 (36.46)	232.14 ^{***}	456 (21.04)	49.48 ^{***}	847 (39.09)	86.33 ^{***}	2167
Mountainous	4632 (50.58)		1362 (14.87)		3624 (39.57)		9158
Plateau	850 (36.97)		372 (16.18)		671 (29.19)		2299
Place of residence							
Urban	1058 (33.85)	242.71 ^{***}	484 (15.48)	1.05	900 (28.79)	138.34	3126
Rural	5214 (49.67)		1706 (16.25)		4242 (40.41)		10,498
Age (Month)							
0–5	285 (20.01)	849.68 ^{***}	309 (21.70)	166.39 ^{***}	349 (24.51)	238.02 ^{***}	1424
6–11	386 (28.05)		330 (23.98)		454 (32.99)		1376
12–23	1165 (42.13)		507 (18.34)		937 (33.89)		2765
24–35	1485 (54.54)		347 (12.74)		1047 (38.45)		2723
36–47	1490 (56.23)		355 (13.40)		1120 (42.26)		2650
48–59	1461 (54.39)		342 (12.73)		1235 (45.98)		2686
Sex of child							
Male	3248 (46.97)	4.93 [*]	1214 (17.56)	22.84 ^{***}	2659 (38.45)	3.01	6915
Female	3024 (45.07)		976 (14.55)		2483 (37.01)		6709
Had Fever							
Yes	4252 (46.04)	0.02	1365 (14.78)	35.96 ^{***}	3354 (36.32)	25.95 ^{***}	9235
No	2008 (46.17)		819 (18.83)		1777 (40.86)		4349
Had diarrhea recently							
Yes	4234 (45.55)	3.38	1371 (14.75)	38.21 ^{***}	3376 (36.32)	26.74 ^{***}	9296
No	2020 (47.24)		810 (18.94)		1751 (40.95)		4276
Age of mother							
<20	175 (34.65)	32.14 ^{***}	82 (16.24)	2.37	161 (31.88)	11.06 ^{**}	505
20–29 years	3250 (45.60)		1113 (15.62)		2655 (37.25)		7127
>30	2847 (47.51)		995 (16.61)		2326 (38.82)		5992
Mother's education level							
Literate or low	4004 (52.86)	350.99 ^{***}	1297 (17.12)	14.10 ^{**}	3277 (43.26)	231.51 ^{***}	7575
Primary	486 (41.64)		172 (14.73)		381 (32.62)		1168
Preparatory	1261 (38.86)		485 (14.95)		1033 (31.83)		3245
Secondary and above	521 (31.85)		236 (14.43)		451 (27.57)		1636
Wealth Index							
Low	3457 (57.07)	686.20 ^{***}	1086 (17.93)	28.21 ^{***}	2863 (47.27)	525.90 ^{***}	6057
Medium	1344 (46.11)		435 (14.92)		1088 (37.32)		2915
High	1471 (31.62)		669 (14.38)		1191 (25.60)		4652
Number of prenatal visits							
0	1814 (50.83)	400.81 ^{***}	1083 (20.34)	306.11 ^{***}	1534 (42.98)	211.50 ^{***}	3569
0–3 times	1238 (38.75)		518 (16.21)		1058 (33.11)		3195
4+	679 (30.91)		345 (15.70)		583 (26.54)		2197

* $P < .05$, ** $P < .01$, *** $P < .001$.

medium wealth index status. Wasting were found to decrease with the increase in the number of prenatal visits.

3.3.3. Underweight. Children living in the plateau region had lower odds of being underweight (OR=0.62, $P < .05$, 95% CI=0.53–0.73) compared to children living in other regions. The odds of underweight was higher in the children living in rural areas. The odds of underweight were also found to increase as children aged. The odds of underweight were 3.17 times (95% CI=2.62–3.85) higher in children aged 48 to 59 months compared to 0 to 5-month-old children. Illness conditions such as recent fever (OR=1.16, $P < .05$; 95% CI=1.05–1.28) and diarrhea (OR=1.29, $P < .05$; 95% CI=1.17–1.43) resulted in a higher odd of underweight in children. Moreover, increases in SES decreased the odds of underweight (i.e., odds of underweight decreased from 0.74 times in medium wealth index to 0.44 times in high wealth index; $P < .001$). Higher levels of mother's education level were found to contribute to decreasing the odds of

underweight. Children whose mothers attended for a prenatal check-up were less likely to be underweight than the children whose mothers never attended for a prenatal check-up. The odds for underweight in 0-3 times prenatal visits was OR=0.77, $P < .05$; 95% CI=0.68–0.86 whereas the odds for 4 times and above prenatal visits was OR=0.70, $P < .05$; 95% CI=0.61–0.79.

4. Discussion

The nutritional status in Yemeni Children is very alarming. The high prevalence of childhood malnutrition in Yemen signifies a major public health problem for the country. The prevalence was found to be so widespread among under-5 Yemeni children that 50% were stunted, 39% were underweight, and 16% were wasted.^[6,18] Malnutrition prevalence varied depending on different background characteristics. The findings of the study suggested that as the age of children increases, the severity of

Table 3
Multivariate logistic regression analysis for HAZ, WHZ, and WAZ (N = 13624).

Characteristics	Stunting		Wasting		Underweight	
	OR	95%CI	OR	95%CI	OR	95%CI
Region						
Coastal	Ref.		Ref.		Ref.	
Mountainous	1.55***	1.36–1.77	0.57***	0.49–0.66	0.81**	0.71–0.92
Plateau	1.15	0.98–1.35	0.71***	0.59–0.85	0.62***	0.53–0.73
Place of residence						
Urban	0.91	0.79–1.04	0.84***	0.71–0.99	0.88	0.76–1.01
Rural	Ref.		Ref.		Ref.	
Age of child (Month)						
0–5	Ref.		Ref.		Ref.	
6–11	1.53***	1.27–1.84	1.05	0.87–1.26	1.43***	1.20–1.70
12–23	3.04***	2.59–3.57	0.75***	0.64–0.89	1.53***	1.32–1.79
24–35	5.46***	4.61–6.47	0.52***	0.43–0.63	2.09***	1.78–2.46
36–47	6.26***	5.20–7.84	0.56***	0.45–0.69	2.63***	2.20–3.14
48–59	6.4***	5.24–7.82	0.46***	0.36–0.59	3.17***	2.62–3.85
Sex of child						
Male	Ref.		Ref.		Ref.	
Female	0.86	0.79–0.94	0.83***	0.74–0.93	0.89	0.81–0.97
Had fever within 2 weeks						
Yes	1.03	0.93–1.14	1.19***	1.05–1.35	1.16***	1.05–1.28
No	Ref.		Ref.		Ref.	
Had diarrhea within 2 weeks						
Yes	1.14**	1.02–1.26	1.22***	1.08–1.38	1.29***	1.17–1.43
No	Ref.		Ref.		Ref.	
Age of mother						
<20	Ref.		Ref.		Ref.	
20–29 years	0.93	0.73–1.17	1.12	0.86–1.47	0.96	0.77–1.21
>30	0.83	0.65–1.06	1.15	0.87–1.52	0.85	0.67–1.07
Mother's education						
Literate or low	Ref.		Ref.		Ref.	
Primary	0.88	0.75–1.04	0.95	0.77–1.17	0.87	0.73–1.03
Preparatory	0.86**	0.76–0.98	0.83*	0.71–0.97	0.85***	0.75–0.96
Secondary and above	0.64**	0.55–0.76	0.83	0.69–1.01	0.69***	0.58–0.81
Wealth Index						
low	Ref.		Ref.		Ref.	
medium	0.66***	0.59–0.75	0.88	0.76–1.02	0.74***	0.65–0.83
High	0.41***	0.36–0.47	0.78***	0.66–0.93	0.44***	0.38–0.50
Number of prenatal visits						
0	Ref.		Ref.		Ref.	
0-3 times	0.76***	0.68–0.84	0.74***	0.65–0.84	0.77***	0.68–0.86
4+	0.67***	0.59–0.76	0.75***	0.64–0.88	0.70**	0.61–0.79

* $P < .05$, ** $P < .01$, *** $P < .001$.

CI = confidence interval, HAZ = height-for-age, OR = odds ratio, WHZ = weight-for-height, WAZ = weight-for-age.

acute malnutrition decreases. In terms of acute malnutrition (wasting), the prevalence in children aged under 24 months is much higher than that of children aged 24 to 59 months. This finding is consistent with research in India, which also reported a particularly high incidence of malnutrition in children aged 2 years and younger.^[19,20] Stunting and underweight were more prevalent in mountainous regions while wasting was most prevalent among children living in coastal regions. The prevalence of all 3 forms of malnutrition (stunting, wasting, underweight) were higher in rural areas compared to urban areas. These results suggest that location (based both on geographical region and place of residence) may have a significant impact on the prevalence on all 3 malnutrition indicators. Policymakers should therefore factor in location in mind when designing policies and programs to combat childhood malnutrition.^[21–24]

In addition, the odds of malnutrition were found to decrease with the increase in the level of mother's education, wealth index,

and the frequency of prenatal visits. This study found wealth index, mother's education and prenatal visits to be significant across all 3 indicators of malnutrition. Several researches have shown that association between poor communities and childhood malnutrition.^[20–25] which is concurrent with the findings of this study. The present study also showed the decrease odds in malnutrition prevalence with the increasing level of mother's education. These results are similar to other studies where researches have suggested that the mother's education level has a far-reaching impact on the size of the family, improving the health of the child and reducing the infant mortality rate.^[26] Similarly, previous studies have found utilization of maternal and child health services to be related to nutrition and growth status of infants and young children in rural areas.^[12] The findings from other studies that mothers seeking health services could have better health and nutrition awareness which could directly impact in the child nutritional status is similar to this study.^[10,12] Illness

conditions in under-5 children such as the recent incidence of fever or diarrhea were found to have higher odds of malnutrition compared to their counterparts. Previous studies have also shown that as the severity of illness increases, child malnutrition increases significantly.^[27]

Previous researches have confirmed that social development status and economic situation are of great importance in describing children's nutritional situation.^[21,22] The urban-rural health disparity is caused by different influencing factors. Simply, redistributing wealth, improving medical care,^[28] providing drinkable water, and sanitation will not improve children's health in country parts, because the impact of these interventions in rural areas is weak.^[29] The necessary interventions to eliminate the difference between the 2 groups will be to focus on behavioral and awareness programs. However, if the health gap between urban and rural areas are caused by differences in the level of key factors, redistributing wealth in rural areas and launching equity programs in key factors will be effective policies to reduce regional inequality.^[30,31]

In addition, the continuation of the war and the serious destruction of social services might have an important influence on the overall health and nutritional status of children and the population as a whole. As long as the conflict is still going on, Yemen's food security is expected to continue to deteriorate, affecting household livelihoods and overall sales ultimately affecting the daily nutritional requirements of the body. The sharp rise in food prices in the local market might deprive the majority of the population relying on local markets to obtain daily food. In addition to higher prices, other challenges include reducing household income from agricultural, fishery or government salaries.^[7,16] Estimates of the health status of women and children are a great reflection of the serious food insecurity situation in most Yemeni households. In Yemen, families suffering from economic difficulties tend to send family members to rural areas and live with large families, where they have a low cost of living and limited access to health care. However, this has strained the resources of the host family and further exacerbated the situation.

There are some limitations to our study. First, the results only show associations rather than casual inference due to cross-sectional study design. A second limitation is that the YNDHS database only collects the behavioral factors, such as infant and young child feeding practices, of children under 2 years old. But the target children in our study is under 5 years old, so we do not have this part of the data which could have affected malnutrition. Third, due to the design and nature of the study, we were unable to reduce bias that could be caused by unmeasured factors, such as gestational weight gain.

5. Conclusion

To conclude, childhood malnutrition remains a major public health problem in Yemen. The regional disparities, socio-economic disparities and the differences in maternal behavioral & characteristics are found to contribute for the high malnutrition prevalence in Yemen. Hence, the government of Yemen should prioritize the targeted health and nutrition programs for children, particular in lower economic children. Overall, the findings of the study could provide an important health and nutrition policy implication to improve the childhood malnutrition in Yemen.

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Author contributions

Conceptualization: Khaled Al-zangabila, Sasmita Poudel Adhikari, Thankam S. Sunil.

Formal analysis: Sasmita Poudel Adhikari, Qingzhi Wang.

Methodology: Sasmita Poudel Adhikari, Huan Zhou.

Writing – original draft: Khaled Al-zangabila, Sasmita Poudel Adhikari.

Writing – review & editing: Khaled Al-zangabila, Sasmita Poudel Adhikari, Qingzhi Wang, Thankam S. Sunil, Scott Rozelle, Huan Zhou.

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