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RESEARCH ARTICLE

Risk factors of malnutrition among preschool children in Sulaimani governorate/Iraq

Dyari Hassan Ahmed1, Abdulfattah H. Hawramei2*

1. Nursing Department, Halabja Technical Institute, Sulaimani Polytechnic University, Sulaimani, Iraq.
2. College of medicine, Community Medicine department, University of Sulaimani, Sulaimani, Iraq.

Corresponding author: Dyari Hassan Ahmed
Email: diaryahmad1992@gmail.com

ORCID

ABSTRACT

Background: *The prevalence of childhood malnutrition is relatively high among children in developing nations, and it is a multifaceted problem. It is necessary to identify the key contributing factors to malnutrition in the target population in order to put control and prevention measures in place and lower the chances of malnutrition. The purpose of this study is to determine the characteristics of undernourished children under the age of five and the risk factors causing malnutrition, in Sulaimani governorate/Iraq.*

Methods: *A case control study was conducted in the maternal and child health clinics in four health centers of Sulaimani, Iraq from October 2021 to April 2022.Case was a child with moderate to severe malnutrition with z-scores < −2SD and > +2SD from the median of WHO reference. Control was a child without malnutrition with z-scores between -2SD and +2SD and the age matched with cases. Direct interviews with the mother of each child were conducted, and the weight and height of each child were measured. We gathered information on socioeconomic features, environmental aspects, child characteristics, caregiver methods and resources.*

Results: *A total of 293 children (74 cases and 219 controls) were selected. The majority (34.8 and 79.1%) of the children in the study were in the age group of 24-35 to 12-23 months in case and control groups respectively. After adjusting all confounders, Mother Visit to ANC during pregnancy and method of child delivery are two of childhood significant associations with malnutrition.*

Conclusion: *promoting birth spacing and utilization of parental visit to health centers is the need of the hour for preventing the occurrence of malnutrition among preschool children. Because of the mother visit to ANC centers and family planning were some of the significant determinants of malnutrition that were found in the study.*

Keywords: *Preschool children, Risk factors, Case control, Malnutrition, Sulaimani*

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INTRODUCTION

According to The World Health Organization, malnutrition refers to deficiencies, excesses, or imbalances in an individual's nutrient intake(WHO, 2021). Forms of malnutrition include undernutrition, overweight/obesity, micro and macronutrient-related malnutrition, and diet related non communicable diseases(MMS/MPHS, 2009). All groups in a society are frequently affected by malnutrition, but new-borns and young children are particularly at risk due to their high nutritional needs for growth and development. (WHO, 2021).

According to newest report of UNICEF and global nutrition report most under five children with malnutrition live in Africa and Asia, as described is Asia 53% of stunting,70% wasting and 48% overweight respectively, while 41% of stunting,27% of wasting and 27% overweight in Africa respectively(Unicef et al., n.d.) with most undernourished children are living in Asia and Africa(UNICEF., 2007). In developing countries, 29.9%, 19.4% and 10% of children under 5 years were stunted, underweight and wasted respectively (UNICEF, 2019). In the Middle East, 3.9%, 9.7%, and 4.4% of children under the age of 5 were reported to be underweight, stunted and wasted respectively(UNICEF-WHO-World Bank, 2017).

In 2018, the prevalence of coexisting stunting, wasting, and overweight in Iraqi children under the age of five was about 4%, 10.3%, and 2.8%, respectively(globalnutritionreport.2018)

Child malnutrition affects children's health, which impairs their capacity to access education and develop skills, and is a major cause of death for children under the age of five. Malnutrition and inadequate nutrition both raise the risk of infection-related death and slow recovery (Mohseni et al., 2019). Malnourished children exhibit one or more of the following forms: underweight, stunting, and wasting (weight for height) (weight for age). This metric is used to assess malnutrition. Additionally, it refers to the deficiency of macronutrients and micronutrients, such as vitamins and minerals(Ahmad et al., 2020).

According to (Kikafunda et al., 1998)have separated the causes of childhood malnutrition in developing nations into four categories: maternal causes, dietary causes, socioeconomic causes, and environmental causes. Furthermore, different studies have reported differing degrees of each risk factor's relation to childhood malnutrition. This variation may be brought about by differences in the socioeconomic, cultural, and environmental aspects of the societies under study.(Anoop et al., 2004; Bloss et al., 2004; Rikimaru et al., n.d.).

The Iraqi Kurdistan region is one of the regions that has undergone extensive economic and social changes in the last three decades. The occurrence of these changes has had a great impact on children. Due to these changes, very few studies related to health and nutrition sciences have been done in this part of the world. therefore, recognizing risk factors for childhood malnutrition, especially those that may be changed, makes it possible to prepare for their avoidance or modification, which in turn decreases the incidence of malnutrition and its children as possible. In this study, we examined the risk factors of malnutrition in pre-schoolers. in the Sulaimani governorate/Iraq.

Objectives of the study

1. To find out the risk factors contributing to different types of malnutrition amongst the children under five years of age.
2. To examine the association between Family Factors and children malnutrition
3. To examine socio-economic factors which contribute to the nutritional status in one to five years children

METHOD

Design of the Study

To achieve the objectives of study among participants a quantitative design "descriptive" study a matched case control approach was carried out.

Study setting

From October 2021 to April 2022 this study carried out in the maternal and child health (MCH) centers in the state of Sulaimani governorate.

Recruitment of respondents

All children from 12-59 months who visited the MCH clinics during the data collection period were screened using their anthropometric data. Malnourished children were first identified and then selected as cases based on the inclusion and exclusion criteria. Cases were children with a diagnosis of moderate to severe malnutrition regardless of the types of malnutrition (can be either underweight, stunting, wasting or a combination of all) with z-scores < −2SD from the median of WHO reference and >+2SD were overweight or obese (Organization, 2006).

Controls were children without malnutrition (have normal anthropometric readings of weight for age, height for age, and weight for height with z-scores between -2SD and +2SD (−2SD ≤ z-scores ≤ +2SD) (Organization, 2006).Age-matched controls and cases were chosen from the same healthcare centers based on first come, first served principles. Children who had mental retardation, physical disabilities, life-threatening illnesses, or who were born prematurely (less than 37 weeks gestation), refugees or immigrants, children who were more than 40 weeks pregnant, twin children, unvaccinated children, and children with a single paternal parent were not included in the study. The lead investigator conducted interviews with the mothers of the respondents using a validated questionnaire after taking their measures. To prevent recollection bias, only children who were accompanied by their own moms were chosen. One household was represented by one child.

Sample size of study

According to the, Kelsey method of sample size calculation for the cases and controls, a minimum of 74 cases and a maximum of 221 controls needed to be identified on a 1:3 ratio.

Procedure for data collection

Mothers of the chosen children were asked to gather information on risk factors after receiving the mothers' informed consent. First-time rapport was established with the mothers. They were requested to complete the questionnaire.

The questionnaire divided to four domains; each domain comprised of several variables as presented below:

A) Childs feeding and characteristics: Residency, Childs daily routing, frequency of child's acute illness (Respiratory tract infections, Gastrointestinal infections) (RTIs/GITI), Immunization history, types of delivery.

B) Caregivers' practices and resources: mother visit to MCH, blood relatives' marriage, anaemia during pregnancy, hypertension during pregnancy, gestational diabetes, mother and nutritional education, maternal use of family planning.

C) Environmental factors such as Drinking water source, Garbage disposal and Sanitary sewage.

D) Household socio-economic characteristics of family: which consist of Overall calculation of domains, educational domain, occupational domain, family possession domain, family domain, home sanitation domain, economic domain, health care domain.

A socioeconomic scale created by El-Gilany et al. was used to measure socioeconomic status (SES) (2012) Tools were then translated into the local Kurdish language, then back into English to ensure that the translation was accurate. The socio-demographic status was measured using a total score of 84 over 7 areas, including education and culture, occupation, family, possessions of the family, home sanitation, economics, and health care. According to the quartiles of the score calculated to evaluate socio-economic status, socio-economic level was divided into extremely low, low, middle, and high levels, depending on the quartiles of the score calculated to assess socio-economic status.

Anthropometric measurements

Infants and young children were weighed and measured in the recumbent position using a measuring board and an electronic pediatric scale with a maximum capacity weight of 12 kg (with accuracy of 0.1 cm). The footboard of the measuring scale is movable and perpendicular to the backboard and has a stationary headboard. A digital scale with a maximum weight capacity of 200 kg and an accuracy of 0.1 kg was used to measure the weight and height of the mothers and children who were older than two years old (with accuracy of 0.1 cm). A side-mounted measuring rod that enables simultaneous measuring and weighing is provided with the digital scale. Participants wore minimal clothing and no shoes throughout the measurement. Their bodies were stretched upward to the full extent in position.

Statistical analyses

Statistical analyses were performed using the IBM Statistical Program for Social Sciences (SPSS) version 25. To identify cases and controls the weight and height of participant computed by using the WHO Anthro (version 3.2.2, 2011) [25].

Chi squared test were used to examine the relationship between childhood malnutrition and study variables. P values less than 0.05 were considered statistically.

RESULTS

Table (1) demonstrate 79.1% of children in control group their age was between 12-23 months and about one-third 34.8% of children in case group their age ranged between 24-35 months. In malnutritional group less than half 45.9% of children were male but in non-malnutritional group 54.3% of children were female. Regarding child daily routing, 94.6% and 98.6 % in case and control groups were spend in

home. More than half of children in both groups were got acute disease in last month (time of interview) moreover majority of both groups got (RTI) accounts for 51.4% and 51.6% respectively. The most of sample in both groups were complete vaccination according to age which accounts for 97.3%, and 97.7% respectively. concerning the types of delivery 50% of cases were delivered normally while more than 60% of controls delivered by caesarean section. There were no significant associations between age of child, child daily routing, acute diseases, immunization history. Also, there is no associations between child feeding practice and between cases and controls. However, an association was found between malnutrition and types of delivery of the child ($p < 0.04$).

Table (2) shows that 50 % of mothers in both case and control groups their ages ranged between (25-34) years old. In regard to stay with mother and child health centers during pregnancy 89.2% of cases and 95.9 of controls visited. More than 80% of both groups' parents had not had blood relative marriage. More than two-third of mothers did not get anaemia during pregnancy in both groups, while 8.1% of cases and 9.1 of controls of mothers had hypertension during pregnancy, also more than 10 % of mothers in cases and controls groups got gestational diabetes before child delivery.85.1% and 95.4% of parents had a family planning before mother pregnancy but majority of mothers in both groups uneducated about nutrition of children, however 19.2% of mother in control group got nutritional education through internet while 2.7% of mothers in case group from reading. Regarding mother knowledge about child growth monitoring more than 90% of cases and control groups had not had related education. The differences between cases and controls with regard to their frequency of Mother visit to MCHC were statistically significant ($p < 0.05$). for cases (89.2%) of mothers visited (Maternal and child health canters compared to (95.9%) among controls. Moreover, Child and family planning were statistically significant ($p < 0.05$) for cases (85.1%) of family planning compared to (95.4%) among controls. However, there were no significant associations between blood relatives' marriage, anaemia during pregnancy, hypertension during pregnancy, mother and nutritional education, mother knowledge about child growth, family history of malnutrition with childhood malnutrition.

Table (3) illustrate environmental factors. more than 60% of both study groups drinking tape water. Majority of cases and control groups had public collection of garbage disposal, while minority of both groups had local sanitation sewage 10.8%,5.5% respectively. However, there is no significant association between malnutrition and environmental factors.

Table (4) demonstrate that 32.4% of cases had very low socioeconomic status compare to 25.5% of control group with mean ages 43±9.8.(both or not).26% of control groups had middle educational level domain while 32.9% of cases had very low educational domain with mean ages 13.5±6.4.regarding occupational domain majority of study groups 41.9%,33.1% of families had higher level of occupation with mean ages 3.8±2.5.domain of family possession 36.8% of cases had higher family proprietary while 23.9% of control group had very low possessions with mean ages 7.2±0.8 , also more than 80% of both groups had low family domain with mean ages 1±0.6. Regarding home and sanitation domain 20.5% of cases families had middle home while 41.6% of families in control group had low quality of home and sanitation with mean ages 4.8±0.9. finally, more than 30% of family study groups had high economic domain with mean ages 9.6±1.6. Although the number of variations occurred in the frequency of study groups but there is no association between socioeconomic domains and case and control groups.

Table 1. Distribution of sample and cross tabulation according to child characteristics.

Child factors	Studied groups		P values
	Case N(%)	Control N(%)	
Age groups of children (Months)			**0.13**
12-23	**40(20.9)**	**151(79.1)**	
24-35	**16(34.8)**	**30(65.2)**	
36-48	**7(33.3)**	**14(66.7)**	
49-59	**11(31.4)**	**24(68.6)**	
Gender			**0.96**
Male	**34(45.9)**	**110(45.7)**	

Female	**40(54.1)**	**119(54.3)**	
Child daily routing			**0.66**
Home	**70(94.6)**	**216(98.6)**	
Kindergarten	**3(4.1)**	**1(0.5)**	
Nursery	**1(1.4)**	**2(0.9)**	
Acute disease			**0.75**
Yes	**40(54.1)**	**123(56.2)**	
No	**34(45.9)**	**96(43.8)**	
If yes			
RTI	**38(51.4)**	**113(51.6)**	**0.97**
GITI	**6(8.1)**	**15(6.8)**	**0.71**
Immunization history			**0.83**
Complete	**72(97.3)**	**214(97.7)**	
Missed	**2(2.7)**	**5(2.3)**	
Types of delivery			**0.04***
Cesarian suction	**37(50)**	**139(63.3)**	
Normal	**37(50)**	**80(36.5)**	
Total	**74**	**219**	

Table 2. Distribution and Cross tabulation between mother characteristic and malnutrition.

Family factors	**Studied groups**		**P values**
	Case N(%)	**Control N(%)**	
Mother age (Years)			0.67
15-24	10(13.5)	34(15.5)	
25-34	37(50)	116(53)	
35-45	27(36.5)	67(30.6)	
46-56	0(0)	2(0.9)	
Mother visit to ANC			0.03*
All	66(89.2)	210(95.9)	
Missed	5(6.8)	8(3.7)	
None	3(4.1)	1(0.5)	
Blood relatives' marriage			0.89
Yes	13(17.6)	40(18.3)	
No	61(82.4)	179(81.7)	
Anaemia during pregnancy			0.72
Yes	22(29.7)	70(32.0)	
No	52(70.3)	149(68)	
Gestational diabetes			0.80
Yes	11(14.9)	30(13.7)	
No	63(85.1)	189(86.3)	
Child and family planning			0.03*
Yes	63(85.1)	209(95.4)	
No	11(14.9)	10(4.6)	
Mother and nutritional education			0.21
Yes	29(39.2)	82(37.4)	
No	44(59.5)	137(62.6)	
If yes			0.78
H educator	11(14.9)	26(11.9)	
Internet	11(14.9)	42(19.2)	
Reading	2(2.7)	5(2.3)	
TV	4(2.3)	7(5.4)	
Total	**74**	**219**	

Table 3. distribution and Cross tabulation between environmental factors and malnutrition.

Environmental factors	Studied groups		P values
	Case N(%)	Control N(%)	
Drinking water source			0.98
Filtered water	11(14.9)	29(13.2)	
Mineral water	4(5.46)	12(5.5)	
Tape water	48(64.9)	146(66.7)	
Well water	11(14.9)	32(14.6)	
Garbage disposal			0.8

Family collection Public collection	7(9.5) 67(90.5)	9(4.1) 210(95.9)	
Sanitary sewage Systemic Local	 66(89.2) 8(10.8)	 202(94.5) 12(5.5)	0.11
Total	74	219	

Table 4. distribution and Cross tabulation between Socioeconomic domains and malnutrition.

Socioeconomic factors	**Studied groups**				**P values**
	Case N(%)	**Control N(%)**	Mean	S.D	
Socio-demographic groups(all)			43	9.83	0.22
Very low	24(32.4)	56(25.5)			
Low	20(27)	55(25.1)			
Middle	15(20.3)	58(26.4)			
High	15(20.3)	50(22.8)			
Educational and culture domain			13.55	6.42	0.58
Very low	24(32.9)	53(24.5)			
Low	15(20.5)	49(22.7)			
Middle	17(23.3)	58(26.9)			
High	17(23.3)	56(25.9)			
Occupational domain			3.86	2.5	0.94
Very low	13(21)	22(12.4)			
Low	12(19.4)	44(24.7)			
Middle	11(17.7)	53(29.8)			
High	26(41.9)	59(33.1)			
Family possessions domain			7.24	0.88	0.61
Very low	19(27.9)	49(23.9)			
Low	24(35.3)	82(40)			
Middle	25(36.8)	74(36.1)			
High	0(0)	0(0)			
Family domain			1	0.63	0.78
Very low	51(85)	149(81.4)			
Low	7(11.7)	28(15.3)			
Middle	2(3.3)	6(3.3)			
High					
Home sanitation domain			4.87	0.95	0.74
Very low	29(39.7)	74(33.8)			
Low	29(39.7)	91(41.6)			
Middle	15(20.5)	53(24.2)			
High	0(0)	1(0.5)			
Economic domain			9.66	1.64	0.53
Very low	21(28.4)	46(21)			
Low	12(16.2)	46(21)			
Middle	16(21.6)	54(24.7)			
High	25(33.8)	73(33.3)			
Total	**74**	**219**			

DISCUSSION

Malnutrition is a multi-dimensional entity. The nutritional status of children under the age of five is affected by different factors. The present study identifies certain risk factors which were found to be significantly higher in children with malnutrition compared to normal children.

Part one: No statistically significant association between different age groups of the under-five children and malnutrition. The findings are parallel with (Senthilkumar SK et al, 2018) who has reported that there is no relationship between child age and malnutrition.

Sex of children were not significantly related to malnutrition of under five years children and the results were supported by a study conducted in east Gojjam zone, Northwest Ethiopia.(Zeray et al., 2019).but in research by (Saadaat Z)female gender was found to be more strongly related to childhood malnutrition. Considering the differences between these studies, it appears that gender is not a biological factor in malnutrition, but affects different stages of childhood growth via various cultural and social factors in different societies.

There is no relationship between child acute illnesses and malnutrition, which is consistent with a study done by (Whye Lian et al., 2012),who did not find any associations between children malnutrition with children frequency of illness and a study done in Erbil by (Chalabi, 2013) emphasized same result.

This study failed to show any association between child immunization and malnutrition. However, Studies done by (Senthilkumar SK et al, 2018)of Fogera District, Northwest Ethiopia has shown that under-five children who are appropriately immunized for age were protected against under nutrition. But There is need for modern studies of nutritional immunology, selecting populations of children based on current definitions of undernutrition was reported by(Prendergast, n.d.).A large proportion of healthy children were delivered baby by Cesarian section method, it mean there is significant association between Cesarian section delivery and malnutrition, however this result incompatible with (Saaka & Hammond, 2020) who reported there was no significant association between caesarean delivery and the other growth indicators, furthermore according to (Sutopa & Bari, 2022) there is strong association between double burden of malnutrition and mode of delivery, children born by CS delivery are more associated with DBM than the children born by normal delivery. A further possible explanation for the controversy could be that in this study we only included those children who their weight should be between 2500-4500 gram at time of delivery and pregnancy period of mother should be between 37-40 weeks.

Part two: Based on the findings of the current study, half of the mothers belonged to the age group between (25-34) years. But there is no significant association between mother age and malnutrition. This finding comparable with(Khan et al., 2019).whoever (Shati et al., 2020) a study conducted at Saudi Arabia showed that found that there is a relationship between mother age and malnutrition. The percentage of adolescent mothers was very low and may explain why no significant relation could be caused by the fact that children of young mothers are traditionally cared for by their grandmothers in Sulaimani may be another reason.

We observed that antenatal care visits had a significant effect on child malnutrition, as mothers who received antenatal care visits gave birth to more nourished children compared to mothers who did not receive any kind of antenatal care service. This finding corresponds with previous works as well(publica & 2016, n.d.; Toma et al., 2018) .The provision of antenatal care (ANC) has been expanding fast worldwide. It offers a range of diversified services which can prevent, detect and treat risk factors early in pregnancy. ANC is often used as a platform for additional interventions, showing a positive influence on maternal and child health status, such as nutrition programs and breastfeeding counselling, or to educate women about the possibilities of family planning and birth spacing.

There is no association between blood relative marriage and child malnutrition This finding is in contrast with a study from Pakistan (Chauhan et al., 2020)demonstrates the significant relationship between consanguineous marriage and child undernutrition. measures like premarital counselling and laboratory tests need to be taken for the individuals opting for consanguineous marriages.

Gestational diabetes and anemia of mother not connected with malnutrition in this study. However, (Iftikhar, 2018; Wang et al., 2018)reported controversy this study.it might be caused by recall bias and lack of knowledge about illnesses that arise during pregnancy of mothers.

It was found that a significant proportion of healthy children came from those families were implemented family planning. similarly reported in other studies. According to (Mozumder et al., 2000)the index children in families with short subsequent birth intervals are significantly more likely to be moderate-to-severely or severely malnourished than those children in families having longer intervals before the birth of another child in the family. This finding has important policy and program implications. Nutritional, health and family planning programs should encourage longer intervals between and to enhance the health of both children and their mothers.

There are no association between mothers' nutritional knowledge and children malnutrition in our study but according to (Appoh & Krekling, 2005) shown that mother's nutritional knowledge is positively associated with the nutritional status of their children. Although it requires standardized knowledge assessment score to correct evaluation of mother knowledge.

Part three: Despite the accumulative evidences on the importance of water and sanitation on children's health(Ahmed et al., 2012; Islam et al., 2013; Sharghi et al., n.d.), our study did not find any association between these variables. A possible reason could be that Sulaimani has reasonably good quality of water and sanitation, thus no association was observed. This is consistent with previous studies in some developing countries (Beiersmann et al., n.d.; Hien & Kam, 2008; Kabubo-Mariara et al., 2009; Masiye et al., 2010).

Part 4: Although more than quarter of cases group had very low socioeconomic status but there is no association between total score of socio-economic status and children malnutrition meanwhile(Urke et al., 2011; Uthman, 2009; van de Poel et al., 2007) demonstrated similar finding. Based on international reports the Sulaymaniyah food market was the least impacted by the devaluation of the Iraqi dinar(European Asylum Support Office, 2021). also, In the KRI, primary education for the first six years of schooling and until age 15 is compulsory and free of cost to citizens(European Asylum Support Office, 2021).

CONCLUSIONS

The results of this study indicated three main factors (Family without childbearing planning, lack of visit of mothers to Antenatal care centers, do not promoting cesarean section delivery method) as underlying factors in malnutrition of children under the age of 5 years. instead, environmental and socio-economic factors will help to reduce the problem of undernutrition in this locality.

ETHICAL CONSIDERATIONS COMPLIANCE WITH ETHICAL GUIDELINES

The protocol of the study was accepted by the council of the College of Nursing and approved by the ethical committee of the College of Medicine / University of Sulaimani. An official letter has been submitted from the College of Medicine to Sulaimani General Directorate of Health in order to obtain facilitation and cooperation.

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AUTHOR'S CONTRIBUTIONS

Study concept; Writing the original draft; Data collection; Data analysis and reviewing the final edition by all author.

DISCLOSURE STATEMENT:

The authors report no conflict of interest.

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