# Risk Factors of Malnutrition among under Five Children Admitted in Kanti Children's Hospital in Nepal

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## ABSTRACT

**Background**

World Health Organization (WHO) stated that malnutrition is a major global health and social problem from which many people are suffering, particularly children. Poor feeding and care practices, insufficient nutrient intake, high rate of infection and teenage pregnancy are the immediate causes of chronic malnutrition.

**Objective**

To identify the risk factors for malnutrition among under five children.

**Method**

A case control study was carried out among the mothers having under-5 years' children who were admitted in the Kanti Children's Hospital of Nepal from 1st August 2019 to 7th September 2020. Non-probability purposive sampling technique was used to select 50 children with malnutrition and 100 children without malnutrition matched on age, sex and setting. A structured interview was used to collect data from mothers of both cases and controls. Descriptive and inferential statistics were used to analyze the data.

**Result**

Present study reveals that 58% girl got marriage before 20 years. After confounders adjusted, mother's age ≥ 20 years at marriage (OR: 2.74, 95% CI: 0.98-7.63. p=0.05), and mother's age ≥ 20 years at child birth (OR: 7.74, 95% CI: 2.37-25.27. p=0.001), were significantly associated with having malnutrition among under five children. Similarly, accessibility of health facility (OR: 3.31, 95% CI: 1-10.94. p=0.05), fathers who completed master in education (OR: 0.08, 95% CI: 0.01-0.88. p=0.04), children who lived in joint family (OR: 0.25, 95% CI: 0.07-0.86. p=0.03), child < 2.5 kg at birth (OR: 0.18, 95% CI: 0.05-0.62. p=0.01), and second and third or above in order (OR: 0.09, 95% CI: 0.01-1.04. p=0.05) had significantly less chance of having malnutrition. Children's whose birth interval was 2-3 years were significantly (OR: 9.74, 95% CI: 1.16-82.23. p=0.04) associated with the occurrence of malnutrition. Children who had suffered from multiple co-morbidities in last one year were (OR: 4.55, 95% CI: 0.48-43.03. p=0.18) more chance of having malnutrition.

Likewise, the mothers who feed colostrum to their child had (OR: 2.28, 95% CI: 0.52-9.26. p=0.29) almost two-fold less chance of having malnutrition. Mothers who had done exclusive breast feeding ≥ 4 months had (OR: 40.55, 95% CI: 3.35-1.490.92. p=0.008) significantly associated with having malnutrition.

**Conclusion**

Low education status of father, living in single family, exclusive breast feeding ≥ 4 months, lack of balance diet were significant risk factors of malnutrition. Based on finding, reliable longitudinal studies, interventions and program to educate parent for prevention of malnutrition are necessary in future.

## KEY WORDS

*Malnutrition, Mothers, Risk factors, Under five children*

## INTRODUCTION

Over 17 million children are affected by severe acute malnutrition (SAM) worldwide. Despite significant progress in resent year approximately 2.9 million children accessed treatment in 65 countries in 2013-only about 17 percent of the children needing treatment.[1]

World Health Organization (WHO) stated that malnutrition is a major health and social problem from which many people are suffering, particularly children. It affects almost 800 million people, 20% of all about half of all children death worldwide.[2] A recent United Nations Children Fund (UNICEF) report shows that Nepal is among 10 countries in the world with the highest stunting prevalence, and one of the top 20 countries with the highest number of stunted children.

Poor feeding and care practices, insufficient nutrient intake, high rate of infection and teenage pregnancy are the immediate causes of chronic malnutrition in Nepal.

Despite several efforts, the situation of malnutrition in Nepal is alarming. According to NDHS 2016, thirty-six percent of children in Nepal are stunted (below-3SD), 27% of all children underweight and 5% are severely underweight.[3] It has decreased to 24.3 percent in 2019. Nepal has the target of reducing this to nine percent by 2030.[4] A study showed that malnutrition affected physical growth, cognitive development and it result impacts on academic performance, health and survival of children.[5] Malnutrition also deepens poverty due to increased health care costs. So, identifying risk factors of malnutrition might be useful effort for the prevention of malnutrition.

## METHODS

A case control study was carried out among the mothers having under-five years' children who were admitted in the Kanti Children's Hospital which is tertiary level hospital of Nepal from 1st August 2019 to 7th September 2020. A non-probability purposive sampling technique was used to select 50 children with malnutrition and 100 children without malnutrition matched on age, sex and setting. ethical approval obtained from Nepal Health Research Council and institutional review committee from Kanti Children Hospital prior to data collection. The research instrument was developed based on literature review. The research instrument used in this study consisted of (i) Socio-demographic characteristics of parents and children (ii) Mother related factors (iii) Child related factors and (iv) Environmental related factors. The content validity of the instrument was established by seeking the opinion of pediatric consultants and a pediatric nursing teacher. The instrument was then translated into Nepali language and reviewed by a language expert for comprehensibility and simplicity of language, and for consistency of the content. The instrument was pre-tested on 15 mothers who were from Dhulikhel Hospital and were excluded from the main study. The collected data were reviewed daily for completeness and accuracy. Edited data were entered into the Statistical Package for Social Science Software (SPSS) version 16.0. Data were analyzed using frequencies and percentages to describe the sample. We used multiple logistic regressions to evaluate the increased odds of having malnutrition by specific risk factors collected in the interview. Odds ratio (ORs), 95% confidence intervals (CIs) and p-values for unadjusted and adjusted models were estimated. Models evaluating child characteristics and risk of malnutrition were adjusted for 15 variables related to parents and children. A p-value of $< 0.05$ was considered significant in discussions of factors related to the odds of having malnutrition.

## RESULTS

Results of the study are presented as descriptive statistics shown by case/controls status, result of regression models. Table 1 and 2 provides Socio-demographic characteristics of parents and children. Table 3, 4 presents child-related characteristics and table 5, 6, 7, 8 present multivariate analysis of logistic regression models investigating association between specific risk factors and odd of having malnutrition.

**Table 1. Socio-demographic characteristics of parents (n=150)**

| Characteristics | Malnutrition n=50 N(%) | No Malnutrition n=100 N(%) | Total n=150 N(%) |
|---|---|---|---|
| **Marriage age of mothers** | | | |
| < 20 | 36(72) | 51(51) | 87(58) |
| ≥ 20 | 14(28) | 49(49) | 63(42) |
| **Age at first child birth** | | | |
| < 20 | 25(50) | 23(23) | 48(32) |
| ≥ 20 | 25(50) | 77(77) | 102(68) |
| **Access to health facility** | | | |
| Yes | 32(64) | 88(88) | 120(80) |
| No | 18(36) | 12(12) | 30(20) |
| **Religion** | | | |
| Hindu | 35(70) | 67(67) | 102(68) |
| Buddhist | 6(12) | 13(13) | 19(12.7) |
| Christian | 6(12) | 16(16) | 22(14.7) |
| Muslim | 2(4) | 3(3) | 5(3.3) |
| Kirat | 1(2) | 1(1) | 2(1.3) |
| **Education of mother** | | | |
| literate | 38(76) | 84(84) | 122(81.3) |
| Illiterate | 12(24) | 16(16) | 28(18.7) |
| **Level of education (n=122)** | | | |
| Primary level (1-8 class) | 21(42) | 30(30) | 51(33.6) |
| Secondary level (9-12 class) | 15(30) | 51(51) | 66(44.6) |

| | | | |
|---|---|---|---|
| Higher education (above 12 class) | 1(2) | 4(4) | 5(3.4) |
| **Education of father** | | | |
| literate | 37(74) | 91(91) | 128(85.3) |
| Illiterate | 13(26) | 9(9) | 22(14.7) |
| **Level of education (n=118)** | | | |
| Primary level (1-8 class) | 17(34) | 26(26) | 43(28.7) |
| Secondary level (9-12 class) | 14(28) | 58(58) | 72(48) |
| Higher education (above 12 class) | 6(12) | 7(7) | 13(8.4) |
| **Occupation of mother** | | | |
| Housewife / Agricultures | 49(98) | 89(89) | 138(92) |
| Working outside (Business) | 1(2) | 11(11) | 12(8) |
| **Occupation of father** | | | |
| Agricultures / Husbandries | 15(35) | 22(22) | 37(26.3) |
| Working outside (Business) | 35(70) | 78(78) | 113(75.3) |
| **Sufficiency of income** | | | |
| Yes | 27(54) | 81(81) | 108(72) |
| No | 23(46) | 19(19) | 42(28) |
| **Type of family** | | | |
| Single | 26(52) | 70(70) | 96(64) |
| Joint | 18(36) | 25(25) | 43(28.7) |
| Extended | 6(12) | 5(5) | 11(7.3) |

Table 1 reveal 50% of mother of case and 23% controls were young (less than 20 years) when their child was born. Demographic information of parents are summarized in the table.

**Table 2. Selected characteristics of children with and without malnutrition (n=150)**

| Characteristics | Malnutrition n=50 N(%) | No malnutrition n=100 N(%) | Total n=150 N(%) |
|---|---|---|---|
| **Age group** | | | |
| ≤ 12 months | 19(38) | 36(36) | 55(36.7) |
| ≤ 13-24 months | 16(32) | 27(27) | 43(28.7) |
| ≤ 25-60 months | 15(30) | 37(37) | 52(34.7) |
| **Birth place of child** | | | |
| Home | 17(34) | 14(14) | 31(20.7) |
| Health institution | 33(66) | 86(86) | 119(79.3) |
| **Birth weight of child** | | | |
| Normal/2.5 kg or above | 35(70) | 88(88) | 123(82) |
| Small or < 2.5kg | 15(30) | 12(12) | 27(18) |
| **Sex of child** | | | |
| Male | 32(64) | 63(63) | 95(63.3) |
| Female | 18(36) | 37(37) | 55(36.7) |
| **Gestational age of child** | | | |
| ≥ 37 weeks | 40(80) | 95(95) | 135(90) |
| < 37 week | 10(20) | 5(5) | 15(10) |
| **Birth order of child** | | | |
| First | 21(42) | 45(45) | 66(44) |
| Second | 13(26) | 32(32) | 45(30) |
| Third | 8(16) | 17(17) | 25(16.7) |
| Fourth and above | 8(16) | 6(6) | 14(9.3) |
| **Birth interval** | | | |
| First born | 22(44) | 46(46) | 68(45.3) |
| < 1 year | 10(20) | 2(2) | 12(8) |
| 1-2 years | 6(12) | 11(11) | 17(11.3) |
| 2-3 years | 4(8) | 20(20) | 24(16) |
| > 3 years | 8(16) | 21(21) | 29(19.3) |

Table 2 shows that more than 1/3 children were ≤ one year in both group and other information of children are summarized in the table.

**Table 3. Feeding practices of children with and without malnutrition (n=150)**

| Characteristics | Malnutrition n=50 N (%) | No malnutrition n=100 N (%) | Total n=150 N (%) |
|---|---|---|---|
| **Colostrum feeding** | | | |
| Yes | 40(80) | 90(90) | 130(86.7) |
| No | 10(20) | 10(10) | 20(13.3) |
| **Prelacteal feeding** | | | |
| Yes | 40(80) | 90(90) | 130(86.7) |
| No | 10(20) | 10(10) | 20(13.3) |
| **Type of prelacteal feeding (n=11)** | | | |
| Honey and Ghee | 3(50) | 0(0) | 3(16.7) |
| Lactogen | 3(50) | 5(100) | 8(72.7) |
| **Duration of exclusive breast feeding** | | | |
| 4 months | 15(30) | 4(4) | 19(12.7) |
| 4-6 months | 32(64) | 59(59) | 91(60.7) |
| > 6 months | 3(6) | 37(37) | 40(26.7) |
| **Duration of breast feeding** | | | |
| < 6 month | 6(12) | 7(7) | 13(8.7) |
| 6 months - 12 months | 12(24) | 7(7) | 19(12.7) |
| 12 months - 24 months | 9(18) | 50(50) | 59(39.3) |
| > 24 months | 17(34) | 26(26) | 43(28.7) |
| Not breast feeding | 6(12) | 10(10) | 16(10.7) |
| **Bottle feeding** | | | |
| Yes | 22(44) | 25(25) | 47(31.3) |
| No | 28(56) | 75(75) | 103(68.7) |

| | | | |
|---|---|---|---|
| **Type of complementary feeding** | | | |
| Jaulo, Lito and Cow milk | 20(40) | 31(31) | 51(34) |
| Cerelec, Lactogen | 6(12) | 11(11) | 17(11.3) |
| Pulses, Rice and Vegetables | 3(6) | 13(13) | 16(10.7) |
| Pulses, Rice and Vegetables, Cereals, Egg, Meat and Fish | 12(24) | 21(21) | 33(22) |
| Almost all type | 9(18) | 20(20) | 29(19.3) |
| Not started | (0) | 4(4) | 4(2.7) |

About 87% of the children were fed colostrum after birth; and 64% of the case and 59% of control children were exclusively breast fed until 4-6 months. Rest of information of children are summarized in table 3.

**Table 4. Selected characteristics of children with and without malnutrition (n=150)**

| Characteristics | Malnutrition n=50 N(%) | No malnutrition n=100 N(%) | Total n=150 N(%) |
|---|---|---|---|
| **Immunization status of child** | | | |
| Only BCG | 1(2) | 1(1) | 2(1.3) |
| All except measles | 15(30) | 25(25) | 40(26.7) |
| Fully vaccinated | 34(68) | 74(74) | 108(72) |
| **Frequency of child's illness within a year** | | | |
| 1-3 times | 10(20) | 57(57) | 67(44.7) |
| 3-6 times | 15(30) | 23(23) | 38(25.3) |
| 6-9 times | 13(26) | 10(10) | 23(15.3) |
| >9 times | 12(24) | 10(10) | 22(14.7) |
| **Type of illness of child (n=149)** | | | |
| Cold, cough and difficulty of breathing | 8(16) | 40(40.4) | 48(32.3) |
| Recurrent diarrhea | 10(20) | 10(10.1) | 20(13.4) |
| Recurrent ARI | 17(34) | 28(28.3) | 45(30.2) |
| Poor appetite | 6(12) | 2(2) | 8(5.3) |
| Almost all | 9(18) | 11(11.1) | 20(13.4) |
| Common cold and diarrhea | 0(0) | 4(4) | 4(2.7) |
| Did not have any any problems | 0(0) | 4(4) | 4(2.7) |

Majority of mothers of case (68%) and control (74%) were fully vaccinated in both group. More children of case (24%) and control (10%) were suffered from illness > 9 times in the past 1 year and other information has summarized in table 4.

When different confounders adjusted, mothers who were ≥ 20 years of old at child birth more likely to have children with malnutrition compared to mothers age < 20 years' old which is statically significant. Fathers who had done master in education and children who lived in joint had significantly less chance of having malnutrition.

**Table 5. Association between parents characteristics and Odds of having malnutrition in children (n=150)**

| Maternal characteristics | Malnutrition | Unadjusted | | Adjusted for demographics | |
|---|---|---|---|---|---|
| | Yes/No | OR (95% CI) | p | OR (95% CI) | p |
| **Age of mother at marriage** | | | | | |
| Under 20 years | 36/51 | 1.00 (Reference) | | 1.00 (Reference) | |
| 20 years or more | 14/49 | 2.47 (1.19-5.15) | 0.015 | 2.74 (0.98-7.63) | 0.05 |
| **Age of mother at first child (years)** | | | | | |
| Under 20 years | 25/23 | 1.00 (Reference) | | 1.00 (Reference) | |
| 20 years or more | 25/77 | 3.35 (1.25-6.91) | 0.001 | 7.74 (2.37-25.27) | 0.001 |
| **Access to health facility** | | | | | |
| Yes | 18/12 | 4.13 (1.79-9.51) | 0.001 | 3.31 (1-10.94) | 0.05 |
| No | 32/88 | 1.00 (Reference) | | 1.00 (Reference) | |
| **Education of mother** | | | | | |
| None/illiterate | 12/16 | 1.00 (Reference) | | 1.00 (Reference) | |
| Literate | 38/84 | 1.66 (0.72-3.84) | 0.24 | 1.01 (0.26-3.9) | 0.98 |
| Primary level (Grade 1-8) | 21/30 | 1.00 (Reference) | | 1.00 (Reference) | |
| Secondary level (Grade 9-12) | 15/51 | 2.38 (1.7-5.31) | 0.034 | 1.59 (0.42-6.02) | 0.49 |
| Higher education level | 1/4 | 2.8 (0.29-26.89) | 0.37 | 0.49 (0.02-9.57) | 0.64 |
| **Education of father** | | | | | |
| None/illiterate | 13/9 | 1.00 (Reference) | | 1.00(Reference) | |
| Literate | 37/91 | 0.39 (1.4-9.02) | 0.008 | 0.18 (0.05-0.69) | 0.01 |
| Primary level (Grade 1-8) | 17/26 | 1.00 (Reference) | | 1.00(Reference) | |
| Secondary level (Grade 9-12) | 14/58 | 2.71 (1.16-0.22) | 0.02 | 1.04 (0.23-4.78) | 0.96 |
| Higher education level | 6/7 | 0.76 (6.31-2.66) | 0.67 | 0.08 (0.01-0.88) | 0.04 |
| **Type of family** | | | | | |
| Single | 26/70 | 1.00 (Reference) | | 1.00(Reference) | |
| Joint | 18/25 | 0.52 (0.24-1.1) | 0.09 | 0.25 (0.07-0.86) | 0.03 |
| Extended | 6/5 | 0.13 (0.09-1.1) | 0.07 | 0.25 (0.05-1.26) | 0.09 |

*Adjusted for access to health facility, education of mothers and fathers, income sufficiency, duration of EBF and BF and colostrum feeding, bottle feeding, age of child, birth weight of child, sex of child, birth interval, frequency of child's illness started of weaning.*

When confounder adjusted, children who are second and third or above child and birth interval is 2-3 year had significantly less chance of having malnutrition. Mothers who had two children almost two-fold more chance of having children with malnutrition compared to mothers who had only one child. But surprisingly mothers who had more than two children were less chance of having children with malnutrition compared to mothers who had only one child which need to discuss more.

Female children had 12% and 22% less chance to have malnutrition in both models. Children who had < 2.5 kg had 69% and 82% less chance of having malnutrition in both model which is statistically significant. Likewise, children who were born at < 37 week had 79% and 86% less chance of having malnutrition in both models.

**Table 6. Association between child related characteristics and Odds of children having malnutrition (n=150)**

| Maternal characteristics | Malnutrition | Unadjusted | | Adjusted for demographics | |
|---|---|---|---|---|---|
| | Yes/No | OR (95% CI) | p | OR (95%CI) | p |
| **Birth order of child** | | | | | |
| First | 22/45 | 1.00 (Reference) | | 1.00 (Reference) | |
| Second | 12/32 | 1.30 (0.56-3) | 0.53 | 0.12 (0.21-1.15) | 0.07 |
| Third and above | 16/23 | 0.70 (0.36-1.59) | 0.39 | 0.09 (0.01-1.04) | 0.05 |
| **Number of child** | | | | | |
| One | 22/43 | 1.00 (Reference) | | 1.00 (Reference) | |
| Two | 12/36 | 0.56 (0.28-1.50) | 0.31 | 2.41 (0.24-24.42) | 0.45 |
| Three | 8/15 | 1.04 (0.38-2.83) | 0.93 | 0.92 (0.12-7.38) | 0.93 |
| >3 | 8/6 | 2.60 (0.80-8.45) | 0.11 | 0.39 (0.05-3.21) | 0.38 |
| **Birth weight of child** | | | | | |
| Normal/2.5 kg or above | 35/88 | 1.00 (Reference) | | 1.00 (Reference) | |
| Small or < 2.5 kg | 15/12 | 0.31 (0.15-0.74) | 0.009 | 0.18 (0.05-0.62) | 0.01 |
| **Sex of child** | | | | | |
| Male | 32/63 | 1.00 (Reference) | | 1.00 (Reference) | |
| Female | 18/37 | 0.96 (0.47-1.94) | 0.905 | 0.78 (0.27-2.18) | 0.63 |
| **Gestational age of child** | | | | | |
| ≥ 37 weeks | 40/95 | 1.00 (Reference) | | 1.00 (Reference) | |
| < 37 week | 10/5 | 0.21 (0.68-0.66) | 0.007 | 0.14 (0.25-0.78) | 0.02 |
| **Birth Interval** | | | | | |
| First born | 22/46 | 1.00 (Reference) | | 1.00 (Reference) | |
| < 1 year | 10/2 | 0.96 (0.19-0.47) | 0.004 | 0.22 (0.02-2.2) | 0.19 |
| 1-2 year | 6/11 | 0.87 (0.87-2.67) | 0.82 | 0.48 (0.08-2.74) | 0.42 |
| 2-3 year | 4/20 | 2.39 (0.72-1.37) | 0.15 | 9.74 (1.16-82.23) | 0.04 |
| More than 3 year | 8/21 | 1.25 (0.31-7.84) | 0.64 | 1.29 (0.32-5.26) | 0.72 |

Mothers who did not feed pre-lacteal feeding to their children were 69% less chance of having malnutrition. Similarly, the mothers who feed colostrums to their child had almost half less chance of having malnutrition compare to who did not feed colostrum to their children. Mothers who had done exclusive breast feeding ≥ 4 months had significantly associated with having malnutrition in both models however duration of breast feeding were not associated to having malnutrition. Likewise, mother who had started weaning after four months were significantly associated of having malnutrition. The mothers who feed jaulo, lito and cow milk (Balance diet) to their child were protected from malnutrition.

**Table 7. Association between child related characteristics and Odds of children having malnutrition (n=150)**

| Maternal characteristics | Malnutrition | Unadjusted | | Adjusted for demographics | |
|---|---|---|---|---|---|
| | Yes/No | OR (95% CI) | p | OR (95% CI) | p |
| **Colostrum feeding** | | | | | |
| Yes | 40/90 | 1.00 (Reference) | | 1.00 (Reference) | |
| No | 10/10 | 1.25 (0.63-4.65) | 0.63 | 2.18 (0.52-9.26) | 0.29 |
| **Pre-lacteal feeding** | | | | | |
| Yes | 40/90 | 1.00 (Reference) | | 1.00(Reference) | |
| No | 10/10 | 0.58 (0.21-1.58) | 0.29 | 0.31 (0.04-2.2) | 0.24 |
| **Duration of exclusive breast feeding** | | | | | |
| < 4 months | 15/4 | 1.00 (Reference) | | 1.00 (Reference) | |
| 4-6 months | 32/59 | 6.91 (2.11-22.5) | 0.001 | 4.6 (0.85-24.96) | 0.08 |
| > 6 months | 3/37 | 46.25 (9.22-232.0) | 0 | 40.55 (3.35-490.92) | 0.004 |
| **Duration of breast feeding** | | | | | |
| < 6 month | 6/7 | 1.00 (Reference) | | 1.00 (Reference) | |
| 6 months - 12 months | 12/7 | 0.5 (0.12-2.1) | 0.34 | 0.34 (0.04-3.35) | 0.36 |

| | | | | | |
|---|---|---|---|---|---|
| 12 months - 24 months | 9/50 | 4.76 (1.3-17.45) | 0.02 | 1.62 (0.22-11.92) | 0.64 |
| >24 months | 17/26 | 1.31 (0.38-4.58) | 0.67 | 0.78 (0.1-5.91) | 0.81 |
| Not breast feeding | 6/10 | 1.43 (0.32-6.32) | 0.64 | 0.51 (0.05-5.05) | 0.56 |
| **Starting of weaning** | | | | | |
| Before 4 months | 21/7 | 1.00 (Reference) | | 1.00 (Reference) | |
| 4-6 months | 13/44 | 10.15 (3.53-29.18) | 0 | 3.38 (0.78-14.34) | 0.1 |
| 6 - 12 months | 15/47 | 9.4 (3.34-26.44) | 0 | 3.55 (0.69-18.22) | 1.13 |
| after 1 year | 1/2 | 6 (0.46-78.71) | 0.68 | 0.65 (0.002-170.7) | 0.88 |
| **Type of complementary feeding** | | | | | |
| Jaulo, Lito and Cow milk | 20/31 | 1.00 (Reference) | | 1.00 (Reference) | |
| Cerelec, Lactogen | 6/11 | 1.18 (0.37-3.7) | 0.77 | 1.04 (1.18-6.16) | 0.97 |
| Pulses, Rice and Vegetables | 3/13 | 2.79 (0.7-11.06) | 0.14 | 3.56 (0.58-21.9) | 0.17 |
| Pulses, Rice and Vegetables, Cereals, Egg, Meat and Fish | 12/21 | 1.12 (0.45-2.79) | 0.79 | 1.37 (0.36-5.22) | 0.64 |
| Almost all type | 9/24 | 1.72(0.66-4.44) | 0.26 | 0.84(0.19-3.8) | 0.82 |

The only significant association found among childhood factors was a protective effect of a child having malnutrition having sickness more than six times in the past one year. Children whose mothers reported they had recurrent diarrhea in the past one year were significantly less chance of having malnutrition than multiple co-morbidity in past one year. Intake of vitamin A and Anthelmintics were not associated to having malnutrition in children. Mothers 'intake of iron and extra food and problem during pregnancy were not associated with having malnutrition which is not shown in table.

**Association between environmental factors and Odds of having malnutrition among children**

Most of the family members of case (90%) and control (96%) were used toilet. Environmental factors were not significantly associated to have malnutrition in children however when model was adjusted, mothers who did not wash hand regularly and did not keep child far away from dust and smoke were more chance to having malnutrition.

**Table 8. Association between child related characteristics and Odds of children having malnutrition (n=150)**

| Maternal characteristics | Malnutrition | Unadjusted | | Adjusted for demographics | |
|---|---|---|---|---|---|
| | Yes/No | OR (95% CI) | p | OR (95% CI) | p |
| **Frequency of child's illness within a year** | | | | | |
| 1-3 times | 10/57 | 1.00 (Reference) | | 1.00 (Reference) | |
| 3-6 times | 15/23 | 0.26 (1.1-0.69) | 0.006 | 0.30 (0.89-1.02) | 0.05 |
| 6-9 times | 13/10 | 0.14 (0.47-0.39) | 0 | 0.14 (0.03-0.59) | 0.008 |
| > 9 times | 12/10 | 0.15 (0.5-0.42) | 0 | 0.09 (0.01-0.49) | 0.005 |
| **Type of illness of child** | | | | | |
| Do not have any problem | 6/6 | 1.00 (Reference) | | 1.00 (Reference) | |
| Recurrent ARI | 17/28 | 1.65 (0.46-5.94) | 0.45 | 3.00 (0.26-34.86) | 0.38 |
| Recurrent diarrhea | 10/10 | 1.00 (0.24-4.18) | 1.00 | 0.52 (0.45-5.71) | 0.59 |
| Cold, cough and difficulty of breathing and diarrhea | 16/55 | 3.44 (0.97-12.13) | 0.05 | 4.55 (0.48-43.03) | 0.18 |
| **Feeding of Vitamin A to child** | | | | | |
| Yes | 33/65 | 1.00 (Reference) | | 1.00 (Reference) | |
| No | 17/35 | 0.04 (0.51-2.14) | 0.903 | 1.88 (0.56-6.31) | 0.31 |
| **Feeding of Anti-helmintic** | | | | | |
| Yes | 32/62 | 1.00 (Reference) | | 1.00 (Reference) | |
| No | 18/38 | 1.09 (0.53-2.2) | 0.81 | 2.7 (0.83-8.74) | 0.1 |
| **Intake of Iron during pregnancy** | | | | | |
| Yes | 28/80 | 1.00 (Reference) | | 1.00 (Reference) | |
| No | 22/20 | 0.3 (0.15-0.66) | 0.003 | 0.31 (0.09-1.04) | 0.06 |

## DISCUSSION

Present study reveals that 58% (72% cases, 51% control) girl got marriage before 20 years and 50% of mother of case and 23% controls were young (less than 20 years) when their child was born which is supported study done by Acharya et al.[6] Mothers'age ≥ 20 years at marriage and at first child birth were significantly associated with having malnutrition among children which might be unequal samples distribution of age group of ≥ 20 years in both group and another cause might be due to over confidence in child caring when they become older.

Majority of mothers (88%) of controls group had access health facility than mothers of case group (66%). It was noticed that the chance of being malnutrition 3.31 times higher among those who had accessibility of health facility again might be same reason which is contradictory with finding done by Egata et al. in Ethiopia.[7]

In present study, mothers who had two children almost double chance of having children with malnutrition compared to mothers who had only one child supported by study done by Wong et al. and Mukuku et al.[8,9] But surprisingly mothers who had more than two children were less chance of having children with malnutrition compared to mothers who had only one child which need to discuss more. Father who had done higher in education had significantly less chance of having malnutrition in children which is supported by study done by Ifrah et al. and Musa et al.[10,11] However, mother who had done master in education had almost 2.8 times more chance of having malnutrition in children that could be less time of mothers in caring of children which is contradictory study done by Jeyaseelan et al.[12] Children who lived in joint family had significantly (p=0.03) less chance of having malnutrition which could be getting more time in caring child from different individuals of family. Similarly, children who had < 2.5 kg at birth had significantly less chance of having malnutrition warrants additional discussion and which is contradictory different studies done by Mukuku et al., Shukla et al. and Gudu et al.[9,13,14]

Children who are second and third or above in order had significantly (p=0.05) less chance of having malnutrition but study done by Yisak showed that birth order of 4 to 5 children were more likely to be underweight.[15] Children's whose birth interval was only 2-3 years were significantly associated with the occurrence of malnutrition.

Likewise, the mothers who did not feed colostrum to their child had almost two-fold more chance of having malnutrition. Similarly, mothers who had done exclusive breast feeding ≥ 4 months had significantly associated with having malnutrition which is supported the studies done by Mishra et al. and Nahalomo et al.[16,17] Similarly another study showed that lack of exclusive breast feeding in first six months was significant risk factors of malnutrition. Similarly, another the studies done by Ambadekar et al. showed mothers who did exclusively breast feed more than six month or less than four months significantly associated with malnutrition.[18] The mothers who feed jaulo, lito and cow milk to their child were protected from malnutrition but it was statically insignificant. In the study done by Musa et al. showed that lack of taking balance diet were associated with malnutrition and another study done by Hossain et al. showed that optimal complementary feeding was less chance of having malnutrition.[11,19]

The only significant association found among childhood factors was a protective effect of a child having malnutrition having sickness more than six times and children who had suffered multiple co-morbidities were more chance of having malnutrition than who had suffered single morbidity in past one year which is supported by the study done by Ansuya et al. and Shukla et al.[20,13]

In present study, environmental factors were not significantly associated to have malnutrition in children however mothers who did not wash hand regularly had more chance of having malnutrition which supported by study done by Musa et al. and Hoq et al. but study done by Kebede et al. showed sources of drinking water and the type of toilet facility were significantly associated with under nutrition and similarly present study showed mother who kept child in dust and smoke were more chance of having malnutrition.[11,21,22]

The findings of the present study however could not be generalized because population in the study is hospital based. The findings provide base line information for future observational study with larger sample.

## CONCLUSION

Malnutrition malnutrition is a major global health and social problem. Low education status of father, living in single family, exclusive breast feeding ≥ 4 months, lack of balance diet were significant risk factors of malnutrition. Finally improving the living standards of the children is important to prevent co-morbidities, to improve the feeding practice and to reduce child mortality.

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