ORIGINAL ARTICLE

Malnutrition & Associated Risk Factors among Under Five Children

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Abstract

Background: Malnutrition continues to be a major public health problem in developing countries. In India, child malnutrition rate is one of the most serious public health problem and highest in the world. The main aim of this study is to find the differentials of under-five malnutrition in rural Rajasthan, India. Another spotlight of this study is to examine the impact of demographic, health and socio-economic factors on malnutrition. Moreover on through review on literature it was found that the present study will be first of its kind in Rajasthan and this arouses the need for the present study. **Objective:** To assess prevalence of malnutrition and to explore the associated risk factors. **Methods:** A community based cross sectional study was conducted on 496 children aged 6-59 months at Jhalawar district. Multistage sampling method was used to select the study subjects. For categorical variables, logistic regression approach using a probit model in STATA V.12.0 was used and the outcomes were compared using odd's ratio (O.R) correlation coefficient among stunning, wasting and underweight was carried out using statistical software R, V.3.1.0. **Results:** The study revealed that, 54%, 84% and 63% of children were stunted, underweight and wasted. The prominent factors having significant effect on stunting, wasting and underweight were birth weight, exclusive breast feeding (EBF) & family income. Significant correlation effect was observed between wasting, underweight and stunting. **Conclusion:** Malnutrition is still an important problem among children aged 6-59 months. Therefore, especial attention should be given on intervention of malnutrition

Key Words

Malnutrition; EBF; Under-five children; Jhalawar

Introduction

Malnutrition is a condition that results from eating a diet in which nutrients are not enough or are too much such that it causes health problems (1-2). Malnutrition continues to be a significant public health problem throughout the low income countries, particularly in South Asia and Sub-Saharan Africa (3-4). Under-nutrition contributes to the death of (5.6) million child death annually i.e. mortality at a rate of 10 children per minute (5). Although there is a perception that the situation of malnutrition among children is worst in Africa, the problem of malnutrition is actually much higher in South Asia as half of the world's malnourished children are found in Bangladesh, India and Pakistan (6). The alarming prevalence of malnutrition is not only a challenge for South Asia or Sub-Saharan Africa but also a challenge across individual countries, individual societies as well as individual families. Even though India has

achieved significant progress in reducing the proportion of under-five children suffering from malnutrition, the magnitude of the problem is still of great concern. For instance, nationally more than 48%, 19.8% and 42.5% of under-5 children were stunted, wasted and underweight respectively (NFHS-3) (7). Under-nutrition is the underlying cause for about 50% of the 2.1 million Under-5 deaths in India each year. The prevalence of under nutrition is the highest in Madhya Pradesh (55%), Bihar (54%), Orissa (54%), Uttar Pradesh (52%) and Rajasthan (51%) (8). Different studies report that several factors closely related to infant and child malnutrition co-exits & interact including low dietary intake, Low Birth Weight, large family size, illiteracy of parental education, breast feeding status, incidence of diarrhoea, previous birth interval, mother's Body Mass Index (BMI), and household economic status. (9, 10, 11)

Aims & Objectives

To assess prevalence of malnutrition and to explore the associated risk factors.

Material and Methods

Study Site: The study was carried out in rural community in Jhalarapatan block, Rajasthan state, Jhalawar District. Administratively the district has 6 blocks. The district has 1481 villages with a rural population of 1181838, comprising of 237702 inhabitants according to census 2011. The under five year constitute 14.7% of the total rural population. Health services are delivered at grass root level through one medical college, 14 community health centres (CHC), 30 Primary health centres (PHC) and 273 sub-health center's (SC) in Jhalawar District. The study area was a tribal hilly area & endemic for malaria and other communicable disease infection.

Sampling procedure: The present study is a cross sectional study design with its study unit as children's aged 6-59 months of age. Sample size was calculated using WHO one sample situation criteria for estimating population proportion with specified absolute precision were allowable difference (d) was fixed at six percent and a confidence level of 95 percent was set hence the estimated sample size was of 243. However to nullify the design effect due to clustering twice study subjects were incorporated in our study thus a sample size of 496 satisfying the inclusive criteria was studied. Multistage sampling procedure was adapted to select the sampling units i.e. the study population. There are 6 blocks in Jhalawar district. One of the blocks in the district was randomly selected, for the present study PHC Mandawar constituting a population of eighteen thousand comprising of 32 villages was chosen. Among 32 villages eighteen villages were randomly shortlisted using simple random sampling technique (SRS) from each selected village a cluster i.e. the household were selected using PPS (Probability proportion to size) technique more than one cluster was chosen from bigger samples thus resulting in a total 20 clusters selection so a total 360 household were selected however only 347 household have under five population hence 347 households were included in the present study. If more than one child between the ages of 6 months to 59 month were found in the same household, then one of them was randomly selected. The child selected was referred to as an index child. If the index child was from a multiple birth (twin or triplet), then both or all the children of that birth were assessed in order to evaluate the cultural practices. A household with no child under five years of age was skipped. Anthropometric measurements (weight and height) were taken, and the children aged 6-59 months were also examined for edema. Values of the reference median (<median – 2 SD) on the basis of 'weight-for-age', 'height-for-age' and 'weight for- height' indices were classified as under-weight, stunting and wasting respectively, while children who were below three SD values of the reference median (<median – 3 SD) were classified as 'severe under-weight, 'severe stunting' and 'severe wasting' respectively.

Ethical clearance: Ethical clearance was obtained from the Institutional Ethical Review Committee of Jhalawar Medical College, Jhalawar& District Health Society. Proper informed consent was obtained from the mothers/caretaker involved in the study.

Results

Coverage particulars and socio-demographic profile of study subjects (Table 1)

A total of 496 children were covered, of which 21% were below 1 year and 53.2% were 1-3 years of age. There were equal numbers of male (48.4%) population as compared to females (51.6%). The mean age of under-five child was almost (29.5±14.5) thirty months. Majority (92%) of the households were Hindus, and about one thirds (36.7%) were living in Kutcha houses, while 28.6% were living in semi Pucca houses. Fifty seven percent of the households were nuclear families, while 17% were

joint families. The average family size was 5.74 (±2.36). Illiteracy rate was much (69.2%) higher among females than males (31.3%). Almost three fourth (73%) male population and less than one fourth (20%) female population were engaged in either agriculture or non-agriculture labor work (Table 1). Safe water was accessible to only 4.5% of the families and nearly all the houses were using firewood & cow dung (96%) for cooking. Sanitary latrine was present only in 13%, while overcrowding was common norm for majority (92%) of the families.

Nutritional status of children under 6 months to 5 years

Prevalence of underweight was about 83% among which 3.6% were severely underweight. The extent of overall stunting was about 54%, and of them, about 2.2% were severely stunted. About 63% of children had wasting, of which 1.63% had severe wasting.

Nutritional status by age groups, gender, socioeconomic and demographic variables

Linear regression analysis (Table 2) was used for predictors of height-for-age, weight-for-age, and weight-for-height and it was observed that stunting was positively associated with birth weight, birth order, ANC visit at health care facilities & family monthly income while negatively associated with age of baby, birth interval, EBF, PNC visit at health care facilities, & family size. Statistically significant association was observed for stunting with age of baby, birth weight, EBF & family monthly income variables. Underweight was positively associated with Birth Weight, Birth Interval & monthly family income while negatively associated with age of baby, Birth Order, Exclusive Breast Feeding, no. of ANC, & PNC visit at health care facilities & family size. Underweight was significantly associated with age of baby. Wasting was negatively associated with age of baby, Birth Order, Exclusively Breast Feeding, PNC visit at health care facilities & family size while positively associated with Birth Weight, Birth Interval, ANC visit at health care facilities, & family monthly income. Statistically significant association was observed with age of baby, birth weight & family monthly income with respect to Wasting. Logistic regression analysis (Table 3a and 3b) was used to identify significant association between malnutrition socio-economic, environment, demographic, maternal and child health variables. The result revealed that exposure to media, type of house, overcrowding, history of mud eating were significantly ($p<0.01$) associated with under-nutrition. Analysis of this study showed that children comes from those family had access to mass media were about 0.3 times less likely underweight risk as compared to those children who don't have exposure to mass media (OR=0.30; CI=0.16- 0.56). Children living in overcrowded families had twice risk (2.01; CI=0.20-0.94) of being underweight as compared to children belonged to non-overcrowding families. Children belonging to families to those living in Pacca and Semi-Pacca houses had 0.29 (CI=0.14-0.60) & 0.45 (CI=0.25-0.82) times lower risk of underweight as compared to children belonging families to those living in kutcha houses. The risk of under-weight was 2.47 (1.23-4.95) and 2.10 (CI=1.18-4.01) times higher among children whose fathers were illiterate and those educated up to middle, as compared to children whose fathers were educated to the level of higher secondary and above. Analysis of this study showed that stunting was 1.6 time more in female than in male child (OR=1.60; CI=1.00-2.56). There was 1.66 time increase risk of stunting among those had received 4 or more ANC visits service (OR=1.66; CI=1.20-2.47) as compared to those mother received less than 4 ANC services at health care facilities during pregnancy. The risk of stunting was about thrice (OR=2.85;CI=1.33-3.14) among children whose mother had any type of severe illness during pregnancy as compared those children whose mother did not had any type of illness during pregnancy. Illiteracy plays a vital role in promoting stunting the risk was 2.55 (1.15-5.64) and 2.29 (CI=1.19-4.39) times higher among children whose mothers were illiterate and those educated up to 8th standards, as compared to children whose mothers were educated to the level of higher secondary and above. There was fourfold increase risk of stunting among whose family had TB case (OR=4.84; CI=1.35-17.39) as compared to whose family did not have TB case. Analysis of this study showed that children from those family who had access to Mass media were about 0.6 times less likely to be stunted as compared to those children who come from family without access to any type of Mass media (OR=30; CI=0.16- 0.56). Children living in overcrowded families had a two times risk (2.2; CI=1.11- 4.35) of being stunted as compared to children from non-overcrowded families.

Children belonging to families those living in Pacca and Semi-Pacca houses had 0.51 (CI=0.32-0.80) &

0.45 (CI=0.29-0.68) times lower risk of stunting as compared to children belonging families to those living in kutcha houses. Risk of Stunting was twice in children (OR=2.16, CI=1.36-3.43) belong to those houses where water supply through hand pump as compared to houses where water supply through other method. Children whose mother's workings were 1.7 (OR=1.71; CI=1.04-2.68) more likely to be stunted as compared to those mothers were housewife. Risk of wasting was significantly ($p<0.01$) 1.64 time higher among children with mothers' BMI <18.5 as compared to children with normal BMI mother. The risk of wasting was 1.9 (1.59-1.93) and 1.3 (CI=1.10-1.79) times higher among children whose mothers were illiterate and those educated up to 8th standards, as compared to children whose mothers were educated to the level of higher secondary and above. Risk of wasting was 0.66 (CI=0.46-0.96) time lower in children having exposure of mass media as compared to family not having access to mass media. Risk of wasting was 0.7 times less in children's whose family used purified water as compare to those who don't have access to safe water supply (Table 3b). Significant positive correlation was observed between wasting, underweight and with underweight and stunting however a significant negative correlation was observed between wasting and stunting (Table 4, Figure 1).

Discussion

In South and South-East Asia, India is the only country with a higher prevalence of under-nutrition in rural areas (underweight 43%, stunting 48% and wasting 20%). Neighbor countries, such as Nepal (underweight 39%, stunting 49% and wasting 13%), Pakistan (underweight 38%, stunting 37% and wasting 13%) and Bangladesh (underweight41%, stunting 43% and wasting 17%) had lower prevalence of under nutrition in rural areas. (12) In the present study, the prevalence of under-weight, stunting and wasting was 83%, 54% and 63%, respectively. Similar (67.8%) results for stunting was reported in a study conducted on Saharia tribe population of Rajasthan by Raoet al (13), however the percentage for wasting was quiet low (13.4%) as compared to the present study. A study conducted among preschool tribal children in Madhya Pradesh, reflects lower prevalence for wasting (32.9%), while the prevalence of stunting was (51.6%) reported in similar fashion (14, 23). The findings of this study shows rural residence as a determinant of child malnutrition which was in accordance with several other studies (13, 14, 23). The present study showed the negative association with age of baby, stunting, underweight & wasting. Higher prevalence of under nutrition among early age of children might be due to faulty feeding practices such as untimely initiation of complementary feeding, non-exclusively breast feeding up to first six months and high prevalence of infections such as diarrhea, ARI, worm infestation in this age group. The prevalence of under nutrition was higher among girls than boys; the cause of this discrepancy might be gender-centric discrimination in early childhood & negative family and community attitudes towards the girl child. Low family income results in lower literacy rate, low purchasing capacity and thus accelerating food insecurity resulting higher under nutrition rates. Present study explores a directly proportional relationship between income of a family to its nutritional status and one can say household per capita income is the indicators for socio-economic development and observed to be associated with underweight and stunting. Similar observations were quoted by other authors too (20, 21, 23). Although the economic differentials seem to be silent in rural society it appears to be an important predictor of childhood nutritional status which can't be ignored. Low income also increases the likelihood of infection through inadequate personal and environmental hygiene mechanisms (20, 21, 23).

Logistic regression revealed that gender of child, level of parental education, exposure to media, overcrowding, history of TB, safe water purification, working status of mother, illness during pregnancy, BMI of mother and morbidity during previous one month were statistically significant factors associated with under nutrition. Similar observations were also showed by other studies (21-28).Stunting was significantly higher among children whose mothers were illiterate or had primary or upper primary education compared with children whose mothers were educated (Higher secondary and above). Higher level of maternal education leads to efficient management of limited household resources, optimum utilization of modern health care services, better health promoting behavior, as well as change in traditional beliefs about diseases causation, and use of contraceptives for birth spacing and more child centred caring practices (29, 30).

Consistent with many other studies (21-28), the multivariate analysis of this study revealed that mother's BMI is positively associated with nutritional status of children. Higher the BMI, lower the risk of being wasted over normal BMI, which is consistent with previous studies conducted elsewhere (Bell et al., 2007). This study showed that underweight mothers have a greater risk of their children being malnourished. A healthy mother can have healthy children. Children of well-nourished mothers had a lower risk of being stunted, wasted and underweight compared to children of undernourished mother. Similar results also observed by other authors (21-28).

Antenatal care, the care a woman receives throughout her pregnancy, is important in determining child nutritional status. Lowest risks of stunted & underweighted children were found among mothers having complete antenatal care visits. Results of this study show that there is a significant association between mother's antenatal care visit and child nutritional status.

Children living in overcrowded families are found to be at greater risk of underweight and stunting, a finding supported by other studies (31). This could be attributed to the infections such as ARI and diarrhoea in overcrowded families however some studies observed a protective effect of family size for under nutrition (21,23, 32).

Present study showed that, families are not treating their drinking water by boiling, straining through cloth and chlorine, children are more likely to be affected by wasting as compared to families treating their drinking water. These finding were similar to study conducted at western Kenya which showed that, children who drank water that was not consistently treated in households were more wasted (21, 23, 32). Therefore, diarrhea and water born diseases caused by unsafe drinking water at households' level might increase the prevalence of malnutrition directly or indirectly.

Apart from the above factors associated with under-nutrition, other factors such as exclusive breastfeeding practices, type of delivery (pre-term/term), place of delivery (institutional or home), type of family, supplementation of IFA tablet during pregnancy, food habits, occupation of father, vegetarian or non-vegetarian, availability of toilet facilities in house, & family size, are all important determinants of under nutrition that needs further study to explore their association

Conclusion

Under five child constitutes the most vulnerable segment of any community and their nutritional status is a sensitive indicator of community health. Concrete steps are needed to uplift socio-economic & environment conditions of the needy tribal population. Improving maternal education along with maternal health promotion, improved sanitation and provision of safe drinking water should be secured in any community.

Recommendation

Emphasis should be given on implementation of nutritional services like ICDS, mid-day meal scheme and food security by income generating activities such as employment guarantee scheme and food for work programmes. Under five children's attending Anganwadi and other learning play school should be provided balanced meal, thus strong political will is needed to improve prevailing health situation.

Authors Contribution

AS: data collection and interpretation and drafted the manuscript. AY: statistical analysis, participated in data interpretation, drafting & revising the manuscript. V B: conceived of the study, design, and coordinated data collection. All authors participated in critically revising the manuscript, and approved the final manuscript.

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Tables

TABLE 1 PERCENTAGE DISTRIBUTION OF SOCIO-DEMOGRAPHIC COVARIATES OF THE STUDY POPULATION

Covariates	Number	Percentage
Sex of Child		
Male	240	48.4
Female	256	51.6
Age of children (months)		
6-12	107	21.6
13-36	264	53.2
37-59	125	25.2
Type of Family		
Nuclear	282	56.9
Joint	86	17.3
Ext. Nuclear	128	25.8
Family size		
1-4	183	36.9
4-9	278	56.0
≥10	35	7.1
Religion		
Hindu	456	91.9
Muslim	40	8.1

Caste		
General	55	11.1
O.B.C	208	41.9
S.C/S.T	233	47.0
Type of House		
Kutcha	182	36.7
Semi- Pacca	142	28.6
Pacca	172	34.7
Educational Status of Mother		
Illiterate	343	69.2
Literate	153	30.8
Educational Status of Father		
Illiterate	155	31.3
Literate	341	68.7
Working Status of Mother		
Working	103	20.8
Not Working	393	79.2
Occupation of Father		
Skilled Worker	133	26.8
Unskilled	363	73.2
Family Wealth Index		
Poor	220	44.4
Moderate	191	38.5
Good	85	17.1

TABLE 2 LINEAR REGRESSION ANALYSIS FOR PREDICTORS OF HEIGHT-FOR-AGE, WEIGHT-FOR-AGE, AND WEIGHT-FOR-HEIGHT Z-SCORES FOR PROMINENT CONTINUOUS VARIABLES AMONG CHILDREN AGED 6-59 MONTHS (N-496)

	Stunting	Underweight	Wasted
Child Level Factors			
Age of baby	-0.56 (-0.72, -0.40)**	-0.42(-0.52, -0.33)**	-0.25 (-0.35, - 0.16)**
Birth Weight	3.11 (1.15, 5.08)**	1.41 (-2.11, 4.94)	5.38 (1.93, 8.88) **
Birth Interval	-0.02 (-0.06, 0.01)	0.04 (-0.03, 0.11)	0.01 (-0.06, 0.08)
Birth Order	0.49 (-0.44, 1.44)	-1.7 (-3.49, -0.09)	-1.1 (-2.76, 0.54)
Exclusive Breast Feeding	-0.41(-0.80, -0.02)*	-0.08(-0.78, 0.60)	-0.56 (-1.2, 0.11)
Maternal Factors			
ANC	0.32 (-0.31, 0.96)	-0.16 (-1.31, 0.98)	0.21(-0.90, 1.34)
PNC	-1.66(-0.78, 0.44)	-0.21 (-1.32, 0.89)	-0.79(-1.87, 0.29)
Household Factors			
Family size	-0.24 (-0.63, 0.15)	-0.50 (-1.21, 0.20)	-0.46 (-1.15, 0.23)
Family monthly Income	0.0002 (0.00002, 0.0005)**	0.00006 (-0.0001, 0.0002)	0.0002(0.00002, 0.0004)*
*** = p<0.05; ** = p<0.005; *** = p<0.0005**			

TABLE 3A LOGISTIC REGRESSION ANALYSIS FOR PROMINENT MATERNAL AND CHILD LEVEL FACTORS WITH STUNTING, UNDERWEIGHT & WASTING

	Stunting	Underweight	Wasted
Exclusive Breastfeeding			
> 6months	1	1	1
< 6months	1.39 (0.85, 2.25)		1.24 (0.64, 2.39)
H/o of Morbidity			
No H/o of morbidity	1	1	1
H/o of morbidity	1.34 (0.84, 2.12)	1.15 (0.61, 2.15)	
ANC care			

≥ 4 visits	1	1	1
≤ 3 visits	1.66 (1.20, 2.47)*	1.57 (0.96, 2.17)	
BMI of mother			
Normal	1	1	1
Underweight	1.05 (0.73, 1.51)		1.02 (0.61, 1.72)
Overweight	2.10 (0.79, 5.56)		0.71 (0.15, 3.27)
Type of delivery			
Term	1	1	1
Pre-term	1.77 (0.89, 3.51)		1.76 (0.77, 4.03)
Place of Delivery			
Hospital	1	1	1
Home	1.17 (0.62, 2.21)		2.09 (0.72, 6.03)
IFA			
Yes	1	1	1
No	1.27 (0.75, 2.15)		1.48 (0.74, 2.98)
Any illness during pregnancy			
No	1	1	1
Yes	2.85 (1.33, 3.14)*	0.58 (0.24, 1.40)	1.59 (0.72, 3.50)
Working status of mother			
Not Working	1	1	1
Working	1.71 (1.04, 2.68)*	2.54 (1.2, 5.2)	1.70 (1.14, 2.75)
Gender of child			
Male	1	1	1
Female	1.60 (1.00, 2.56)*	1.07 (0.74, 1.54)	1.29 (0.90, 1.84)
Literacy status of Mother			
High School & Above	1	1	1
Illiterate	2.55 (1.15, 5.64)*	2.30 (0.87, 6.03)	1.9 (1.43,1.94)*
Up to Primary	1.16 (0.49, 2.75)	1.50 (0.55, 4.02)	0.97 (0.37, 2.54)
Up to Middle	2.29 (1.19, 4.39)*	1.90 (0.93, 3.95)	1.3[1.10, 1.79]*
* = p<0.05; ** = p<0.005; *** = p<0.0005			

TABLE 3B LOGISTIC REGRESSION ANALYSIS FOR HOUSEHOLD, ENVIRONMENTAL AND SANITATION LEVEL FACTORS WITH STUNTING, UNDERWEIGHT & WASTING

	Stunting (OR 95% CI)	Underweight OR (95% CI)	Wasted (OR 95% CI)
Type of family			
Nuclear	1	1	1
Joint	1.36[0.84, 2.21]	1.24[0.64, 2.43]	0.90[0.55, 1.48]
Ext. Nuclear	1.26[0.83, 1.92]	1.05[0.57, 1.92]	1.41[0.90, 2.12]
Food			
Vegetable	1	1	1
Non-vegetable	1.07[0.75, 1.53]	1.37[0.81, 2.29]	1.10[0.76, 1.59]
History of TB in Family			
No	1	1	1
Yes	4.84[1.35, 17.39]*	2.28[0.70, 7.39]	2.37[0.66, 8.51]
Exposure to Media			
No	1	1	1
Yes	0.62[0.43, 0.90]*	0.30[0.16, 0.56]***	0.66[0.46, 0.96]*
Type of House			
Kutcha	1	1	1
Pucca	0.51[0.32, 0.80]**	0.29[0.14, 0.60]**	0.68[0.42, 1.08]
Semi- Pucca	0.45[0.29, 0.69]***	0.45[0.25, 0.82]**	0.71[0.46, 1.10]
Over-crowding			
No	1	1	1

Yes	2.2[1.11, 4.35]*	2.01[0.15, 3.19]*	1.30[0.65, 2.69]
Safe Water supply			
Hand pump	1	1	1
Other source	2.16[1.36, 3.43]**	1.32[0.71, 2.43]	1.29[0.80, 2.09]
History of mud eating			
No	1	1	1
Yes	1.44[0.79, 2.64]	1.90[1.22, 2.95]**	0.87 [0.55, 1.35]
Umbilical-Cord Application			
No	1	1	1
Yes	1.40[0.79, 2.46]	0.89[0.59, 1.36]	1.01 [0.67, 1.51]
Place of Defecation			
Closed	1	1	1
Open air	3.01[1.68, 5.30]	2.27[1.21, 4.23]	2.92 [1.66, 5.13]
Water Purification			
No	1	1	1
Yes	1.25[0.52, 2.98]	0.71[0.35, 1.44]	0.33 [0.13, 0.75]**
* = p<0.05; ** = p<0.005; *** = p<0.0005			

TABLE 4 PEARSON CORRELATION COEFFICIENT BETWEEN WASTING, UNDERWEIGHT AND STUNNING

	Wasting	Underweight	Stunning
Wasting	1	0.59*	-0.245*
Underweight	0.59*	1	0.551*
Stunning	-0.245*	0.551*	1
* Correlation is Significant at .01 level (2 tailed)			

Figures

FIGURE 1