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"Determinants of severe acute malnutrition among children of 6-59 months residing in slum area of Bilaspur city, Chhattisgarh: A case control study"

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ABSTRACT
Background: Severe acute malnutrition (SAM) is the most extreme and visible form of undernutrition. Children with Severe acute malnutrition are nine times more likely to die than well nourished children.Severe acute malnutrition is defined by a very low weight for height (below -3 z scores of the median WHO growth standards), by visible severe wasting, or by the presence of nutritional oedema.
Objective: To assess the determinants of SAM among children of 6-59 months residing in slum area of Bilaspur city, Chhattisgarh.
Material and method – A community based matched case control study carried out among children of 6-59 months registered in Angan Wadi Centres (AWC) of slum area of Bilaspur city, Chhattisgarh. The sample size was calculated through STATCAL application of Epi-Info assuming a two-sided confidence level at 95%, 80% power (1-β) of the study, and a case–control ratio of 1:1. The percentage of control exposed for pre lacteal feeding was taken as 43% with an odds ratio (OR) of 2.29 based on a case–control study done in India. The sample size was 208 (104 cases and 104 control). Cases were children of age 6-59 months, registered in Angan Wadi Centres with weight for height <-3 SD below the median according to WHO child growth standards 2006 and controls were selected from the same locality of the cases with age difference of not more than 2 months. Direct interview of mothers were taken to assess information regarding different determinants. Anthropometric measurements of cases and control and their respective mothers were taken.Statistical analysis was done with help of statistical software SPSS for Windows 20 version. Descriptive statistics were expressed as percentages and frequency. Risk was estimated using odds ratio with 95% CI. Multivariable logistic regression was used to identify the risk factors for SAM. Odds ratio and adjusted Odds ratio were applied to measure the strength of relationship between the various socioeconomic, environmental, maternal, nutritional and utilization of services provided by Angan Wadirelated variables of malnutrition in the study area.The level of significance was taken at p value <0.05.
Result- After adjusted for other variables family size more than 5 (AOR 4.23,95% CI 1.66-10.75), birth interval of <24 months (AOR 6.38, 95 % CI 2.74 -14.90), home delivery (AOR 3.89, 95 % CI 1.15-13.11), birth weight <2.5 kg (AOR 7.43, 95% CI 2.44- 22.60),deficiency of protein in diet (AOR 8.13, 95 % CI 3.49- 18.92), ARI in last two weeks (AOR 5.62, 95 % CI 1.95- 16.25) and children who were not taken full doses of vit A supplementation (AOR 3.90, 95 % CI 1.43-10.60) were found significantly associated with SAM.
Conclusion- Family size, birth interval, birth weight, protein in diet, ARI in last two weeks and vitamin A supplementation were important determinants of SAM among children.
Keywords: Severe acute malnutrition, determinants, Angan Wadi Centres.

I. INTRODUCTION-

Malnutrition refers to deficiencies, excesses or imbalances in a person's intake of energy and/or nutrients. The term malnutrition covers 2 broad groups of conditions. One is 'undernutrition'—which includes stunting (low height for age), wasting (low weight for height), underweight (low weight for age) and micronutrient deficiencies or insufficiencies (a lack of important vitamins and minerals). The other is overweight, obesity and diet-related noncommunicable diseases.[1]Severe acute malnutrition is the most extreme and visible form of undernutrition. Children with Severe acute malnutrition are nine times more likely to die than well-nourished children.[2]Severe acute malnutrition is defined by a very low weight for height (below -3 z scores of the median WHO growth standards), by visible severe wasting, or by the presence of nutritional oedema.[3]

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Malnutrition among children remains a significant problem in India. It has been estimated that in India, 65% i.e., nearly 80 million children under 5 years of age suffer from varying degrees of malnutrition.[4] The findings of National Family Health Survey (NFHS-4 2015-16) reveals that in India, among under 5 children 38.4% were stunted, 35.7% were underweight, 21.0% were wasted and 7.5% were severely wasted.[5] Compared to the national standards, scenario of malnutrition amongst children in Chhattisgarh according to National Family Health Survey (NFHS-4) data for stunted, underweight, wasted and severely wasted are 37.6%, 37.7 %, 23.1% and 8.4% respectively.[6] The percentage of children under 5 years of age for stunted, underweight, wasted and severely wasted are 34.1%, 26.8%, 33.3% and 13.4% respectively for Bilaspur district.[7]

The factors associated with the problems of severe acute malnutrition may differ among regions, zones and communities, as well as over time. So it is essential to assess the determinants associated with SAM. Management of SAM in India is a national priority.[8] Despite of various interventions done to prevent malnutrition, still the problem is significant in India. Thus this study was conducted to assess the determinants of SAM in children of 6-59 months.

II. MATERIAL AND METHOD

STUDY SETTING- A community based matched case control study carried out among children of 6-59 months registered in Angan Wadi Centresof slum area of Bilaspur city, Chhattisgarh from June 2018 to August 2019.

SAMPLE SIZECALCULATION- Sample size was calculated through STATCAL application of Epi-Info assuming a two-sided confidence level of 95%, 80 % power of the study and case control ratio of 1:1. The percentage of control exposed for pre-lacteal feeding was assumed at 43% with an odds ratio (OR) of 2.29 based on a case control study done in India.[9]The sample size was 208 (104 cases and 104 controls).

SELECTION OF PARTICIPANTS- List of Angan Wadi Centres(AWC) was obtained from ICDS office Bilaspur. Anganwadi centres were selected randomly till the required number of cases and controls were found. In this way we visited 196 Angan Wadi Centres and we get our study participants through 93 AWC. Cases were the children of age 6-59 months, registered in AWC with weightfor height Z-score<-3SD below the median according to WHO 2006 growth standards. Controls were selected from the same locality as of the cases with age difference of not more than 2 months and having weight for height Z-score >-2SD according to WHO 2006 growth standards. Children with birth defects were excluded from study.

III. DATA COLLECTION-

The Anganwadi centres were visited daily excluding Sundays and holidays. In AWC weight for age was taken to classify children as malnourished or healthy. We have selected children who were coming in red zone of growth chart. Anthropometric measurements (weight and recumbent length/height) of these children were taken and compared with weight for height indicators Z–score as per WHO 2006 growth standards.Anthropometric measurements (weight and recumbent length/height) of these children were taken during daytime and compared with weight for height indicators Z-score as per WHO 2006 growth standards. Measurement of weight was done usingmanual weighing machine with zero adjustment each time, with minimum clothing and to the nearest of 100 gm. In children who were not able to stand alone, mother was made to stand on the scale and weighed and then scale was zeroed, mother was given her child to hold.and child's weight obtained by substractionof mother's weight from additional weight of mother's and her child's weight.

Length was recorded for children under 2 years of age. Hairpins were removed and braids undone. Length was measured using infantometer. The child was placed supine, legs were straightened, keeping feet at right angles to legs, with toes pointing upwards.For children >2 years of age a vertical measuring scale or wall was used, which itself is graded and zero is located exactly at the angle formed by the ground and the wall. The child must stand bare-footed and the heels, buttocks, shoulders and occiput touching the wall and looking straight ahead. The chin should be straight (Frankfurt plane). The reading was taken after placing a horizontally held scale in order to touch the top of the head.If the weight for height was <-3 SD below the median according to WHO child growth standards 2006, child was categorized under case. House of the case was visited with the help of Angan Wadi worker. Matching was done for age and locality. Detailed history was taken from mother of cases and controls with the help of predesigned pretested questionnaire. Information about all possible variables were obtained in the same manner both for cases and controls. Anthropometric measurement (weight and height) of all mothers were also done. Body mass index

(BMI) of mother was obtained by weight divided by height squared in kg/m^2. Mothers were classified using WHO classification into obese- BMI ≥30 kg/m^2, overweight- BMI 25.0-29.9 kg/m^2, normal- BMI 18.5-24.9 kg/m^2 and underweight having BMI below 18.5 kg/m^2.

IV. STATISTICAL ANALYSIS

After collection of all information compilation of data was done in MS Office Excel Spreadsheet and statistical analysis was done with help of statistical software SPSS for Windows 20 version. For analysis variables were categorized into five hierarchical levels:

1) **Sociodemographic variables** such as age of mother, education of father and mother, their occupation, gender of the child, religion, caste, type of family, family size, socioeconomic status and history of migration in last 5 years.
2) **Maternal and child related factor**- mother's age at marriage and at time of childbirth, BMI of mother, health injurious habits in mother (tobacco chewing, drinking alcohol, smoking), contraception used, birth interval, complication during pregnancy, number of antenatal visits, place of delivery, preterm delivery, birth weight of child, birth order, total number of children.
3) **Environmental factors** such as type of house, dampness, overcrowding, source of water, treatment of water done, handling of water and method of disposal of nightsoil.
4) **Nutritional status of child**such as type of diet, initiation of breast feeding, colostrum given, prelacteal feed, exclusive breastfeeding, initiation of weaning, milk in diet, bottle feeding, deficiency of calorie and protein in diet, history of fever, diarrhoea and ARI (acute respiratory infection) in last two weeks.
5) **Availing of services provided by Anganwadi** for mother and children such as supplementary nutrition taken during pregnancy and lactation, supplementary nutrition for children, iron and folic acid supplementation during pregnancy, health education regarding child rearing, immunization and vitamin A supplementation.

Descriptive statistics were expressed as percentages and frequency. The Association between SAM and exposed variables were examined using bivariate analysis. The level of significance was taken at P value <0.05.Variables that were statistically significant were included in multivariable analysis. For multivariable analysis a hierarchial approach was used[10]. The factors that were statistically significant in one model were considered in the successive model, starting from sociodemographic variables (Model 1), maternal and child related variables (Model 2), environmental variables (Model 3), nutritional variables (Model 4), followed by Anganwadi services related variables in Model 5. Model 5 was the final Multivariable regression analyses model.Odds ratio and adjusted Odds ratio were applied to measure the strength of relationship between the various socioeconomic, environmental, maternal and child, nutritional and avail of AnganWadi services related variables of SAM in the study area.

V. RESULT-

Table 1 depicts the frequency table of socio-demographic variables among cases and controls. Male and female children were almost equal in this study. The majority, 98 (94.2%) of the cases and 97 (93.3%) of the controls, were Hindus. Most of the children among cases 47 (45.2%) and 54 (51.9%) in controls belongs to OBC. 81 (77.9%) of the cases and 91(87.5%) of controls belongs to nuclear family.

The mean±SD ages of the mothers of the cases and controls were 27.18±4.60 and 28.21±3.69 years respectively and range 20-40 yrs. The illiteracy rate of mothers was higher among cases 33 (31.7%) than the controls 14 (13.5%) and among the fathers of the cases 17 (16.3%) than the controls 11 (10.6%). There was preponderance of employed mothers among cases 18 (17.3%) in comparison to the controls 10 (9.6%). Majority of fathers of cases were unskilled workers 53 (50.9%), while majority of fathers of controls were semiskilled workers 48 (46.1%). Family size of >5 members were 41 (39.4%) among cases in comparison to 19 (18.3%) among controls. More than half (52.9%) of the cases belong to poor class while, among controls majority (48.1%) belongs to lower middle class of socioeconomic status according to modified B.G Prasad's classification (2018). History of migration in last 5 years in family was present in 16 (15.4%) in families of SAM children than 6 (5.8%) in families of controls.

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Table 1: Sociodemographic characteristics of participants.

Characteristics	Cases (%) n=104	Controls (%) n=104	Total (%) n=208
Gender			
Male	53 (51)	49 (47.1)	102 (49.0)
Female	51 (49)	55 (52.9)	106 (51)
Religion			
Hindu	98 (94.2)	97 (93.3)	195 (93.8)
Muslim	6 (5.8)	7 (6.7)	13 (6.2)
Caste			
OBC	47 (45.2)	54 (51.9)	101 (48.5)
SC	28 (26.9)	14 (13.5)	42 (20.2)
ST	10 (9.6)	6 (5.8)	16 (7.7)
Others	19 (18.3)	30 (28.8)	49 (23.5)
Type of family			
Nuclear	81 (77.9)	91 (87.5)	172 (82.7)
Joint	23 (22.1)	13 (12.5)	36 (17.3)
Mother's age			
20 or less	3 (2.9)	0	3 (1.4)
21-25	31 (29.8)	25 (24.0)	56 (26.9)
26-30	46 (44.2)	55 (52.9)	101 (48.5)
31-35	17 (16.3)	20 (19.2)	37 (17.8)
36-40	7 (6.7)	4 (3.8)	11 (5.3)
Father's education			
Illiterate	17 (16.3)	11 (10.6)	28 (13.5)
Primary school	27 (26.0)	34 (32.7)	61 (29.3)
Secondary	32 (30.8)	34 (32.7)	66 (31.7)
Higher secondary	23 (22.1)	21 (20.2)	44 (21.1)
Graduate and above	5 (4.8)	4 (3.8)	9 (4.3)
Mother's education			
Illiterate	33 (31.7)	14 (13.5)	47(22.6)
Primary school	19 (18.3)	30 (28.8)	49 (23.5)
Secondary	24 (23.1)	31 (29.8)	55 (26.4)
Higher secondary	22 (21.1)	21 (20.2)	43 (20.7)
Graduate and above	6 (5.8)	8 (7.7)	14 (6.7)
Mother's working status			
Housewife	86 (82.7)	94 (90.4)	180(86.5)
Working	18 (17.3)	10 (9.6)	28 (13.5)
Father's occupation			
Skilled	15 (14.4)	24 (23.1)	39 (18.7)
Semiskilled	31(29.8)	48 (46.1)	79 (37.9)
Unskilled	53 (50.9)	30 (28.8)	83 (39.9)
Unemployed	5 (4.8)	2 (1.9)	7 (3.4)
Family size			
>5	41 (39.4)	19 (18.3)	60 (28.8)
≤5	63 (60.6)	85 (81.7)	148 (71.2)
Socio-economic status			

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Upper high	1 (1.0)	2 (1.9)	3 (1.4)
High	3 (2.9)	4 (3.8)	7 (3.3)
Upper middle	12 (11.5)	22 (21.2)	34 (16.3)
Lower middle	33 (31.7)	50 (48.1)	83 (40)
Poor	55 (52.9)	26 (25.0)	81 (39)
Migration in last 5 years			
Yes	16 (15.4)	6 (5.8)	22 (10.6)
No	88 (84.6)	98 (94.2)	186 (89.4)

Table 2 Association between severe acute malnutrition and exposure variables in bivariate analysis

Characteristics	Cases (%) n=104	Controls (%) n=104	COR (95%CI)	p Value
Sociodemographic variables				
Maternal education				
Illiterate	33 (31.7)	14 (13.5)	2.48 (1.22-5.04)	0.010*
Literate	71 (68.3)	90 (86.5)	Ref	
Family size				
>5	41 (39.4)	19 (18.3)	2.91 (1.54-5.49)	0.001*
≤ 5	63 (60.6)	85 (81.7)	Ref	
Migration in last 5 years				
Yes	16 (15.4)	6 (5.8)	2.97(1.11-7.92)	0.024*
No	88 (84.6)	98 (94.2)	Ref	
Maternal and child related variables				
Mother's age at marriage				
<20 yrs	51 (49.0)	19 (18.3)	4.31 (2.30-8.01)	0.000*
20-34 yrs	53 (51.0)	85 (81.7)	Ref	
BMI status of mother				
Under/ overweight	25 (24.0)	12 (11.5)	2.43 (1.15-5.14)	0.018*
Normal weight	79 (76.0)	92 (88.5)	Ref	
Birth interval				
<24 months	64 (61.5)	28 (26.9)	4.34 (2.42-7.81)	0.000*
Single child />24 months	40 (38.5)	76 (73.1)	Ref	
Place of delivery				
Home	31 (29.8)	10 (9.6)	3.99 (1.84-8.67)	0.000*
Institutional	73 (70.2)	94 (90.4)	Ref	
Health injurious habits in mother				
Yes	15 (14.4)	6 (5.8)	2.75 (1.02-7.40)	0.038*
No	89 (85.6)	98 (94.2)	Ref	
Preterm delivery				
Yes	17 (16.3)	7 (6.7)	2.71 (1.07- 6.84)	0.030*
No	87 (83.7)	97 (93.3)	Ref	
Birth weight				
<2.5 kg	36 (34.6)	8 (7.7)	6.35 (2.78-14.52)	0.000*
≥2.5 kg	68 (65.4)	96 (92.3)	Ref	
Total number of children				
>2	56 (53.8)	21 (20.2)	4.61 (2.49-8.53)	0.000*
≤2	48 (46.2)	83 (79.8)	Ref	

Environmental variables				
Overcrowding in house				
Yes	64 (61.5)	42 (40.4)	2.36 (1.35-4.12)	0.002*
No	40 (38.5)	62 (59.6)	Ref	
Nutritional variables				
Initiation of breastfeeding				
More than one hour	44 (42.3)	16 (15.4)	4.03 (2.08-7.80)	0.000*
Within one hour	60 (57.7)	88 (84.6)	Ref	
Prelacteal feed given				
Yes	15 (14.4)	6 (5.8)	2.75 (1.02-7.40)	0.038*
No	89 (85.6)	98 (94.2)	Ref	
Exclusive breastfeeding for 6 months				
No	66 (63.5)	42 (40.4)	2.56 (1.47-4.49)	0.001*
Yes	38 (36.5)	62 (59.6)	Ref	
Initiation of weaning at age 6 months				
No	56 (53.8)	30 (28.8)	2.88 (1.62-5.10)	0.000*
Yes	48 (46.2)	74 (71.2)	Ref	
Bottle feeding				
Yes	24 (23.1)	7 (6.7)	4.16 (1.70-10.15)	0.001*
No	80 (76.9)	97 (93.3)	Ref	
Deficiency of calorie in diet				
Yes	67 (64.4)	30 (28.8)	4.47 (2.49-8.01)	0.000*
No	37 (35.6)	74 (71.2)	Ref	
Deficiency of protein in diet				
Yes	70 (67.3)	22 (21.2)	7.67 (4.11-14.32)	0.000*
No	34 (32.7)	82 (78.8)	Ref	
Fever in last two weeks				
Yes	28 (26.9)	16 (15.4)	2.03 (1.02-4.03)	0.042*
No	76 (73.1)	88 (84.6)	Ref	
Diarrhoea in last two weeks				
Yes	29 (27.9)	11 (10.6)	3.27 (1.53-6.98)	0.002*
No	75 (72.1)	93 (89.4)	Ref	
ARI in last two weeks				
Yes	31 (29.8)	10 (9.6)	3.99 (1.84-8.67)	0.000*
No	73 (70.2)	94 (90.4)	Ref	
Utilization of services provided by Angan Wadi Centres				
Utilization of nutritional services of AWC by children				
No	35 (33.7)	18 (17.3)	2.64 (1.38-5.04)	0.003*
Yes	69 (66.3)	86 (82.7)	Ref	

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Days of eating RTE food packet provided by AWC by pregnant and lactating mothers				
≤15 days	96 (92.3)	86 (82.7)	2.51 (1.04-6.07)	0.036*
>15 days	8 (7.7)	18 (17.3)	Ref	
Vitamin Asupplementation (as per age)				
No	37 (35.6)	13 (12.5)	3.87 (1.91-7.83)	0.000*
Yes	67 (64.4)	91 (87.5)	Ref	

*p<0.05,COR- crude odds ratio; Ref- reference category, ARI- acute respiratory illness, AWC- Angan Wadi Centre, RTE- ready to eat.

Among all the variables 25 differed between cases and controls in bivariate analysis (p<0.05) as in Table 2. These variables were socio-demographic variables such as mother's education, family size and migration in last 5 years, maternal and child related variables - mother's age at marriage, BMI status of mother, birth interval, place of delivery, addiction in mother, preterm delivery, birth weight, total number of children, environmental variables includes only overcrowding, nutritional factors such as initiation of breastfeeding, prelacteal feed, exclusive breastfeeding for 6 months, initiation of weaning at 6 months, bottle feeding, deficiency of calorie, deficiency of protein in diet, fever, diarrhoea and ARI in last two weeks, utilization of services provided by Angan Wadi related variables such as utilization of supplementary nutrition by children, utilization of ready to eat food packet by mothers during pregnancy and lactation and vitamin A supplementation taken as per age.

Table 3. Multivariate analysis of determinants of severe acute malnutrition.

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Sociodemographic variable					
Maternal education	2.49 (1.21-5.12)	-	-	-	-
Family size	2.53 (1.31-4.86)	3.48 (1.48-8.21)	3.84 (1.65-8.92)	4.08 (1.43-11.63)	4.23 (1.66-10.75)
Migration in last 5 years		-	-	-	-
Maternal and child related variable					
Maternal age at marriage		2.84 (1.29-6.25)	3.42 (1.60-7.31)	-	-
BMI status of mother		-	-	-	-
Birth interval		6.19 (2.83-13.56)	7.01 (3.15-15.62)	5.39 (2.04-14.26)	6.38 (2.74-14.90)
Place of delivery		3.48 (1.25-9.72)	4.73 (1.71-13.04)	4.57 (1.16-18.04)	3.89 (1.15-13.11)
Health injurious habits in mother		-	-	-	-
Preterm delivery		-	-	-	-
Birth weight		7.08 (2.44-20.51)	7.33 (2.69-20.05)	8.73 (2.62-29.02)	7.43 (2.44-22.60)
Number of children		3.16 (1.43-6.97)	2.68 (1.22-5.86)	-	-
Environmental					

variable						
Overcrowding	-		-		-	
Variable affecting nutritional status of child						
Initiation of BF			-		-	
Prelacteal feed given			-		-	
Exclusive BF for 6 months			-		-	
Initiation of weaning at 6 months			-		-	
Bottle feeding			-		-	
Deficiency of calorie			-		-	
Deficiency of protein			4.18	(1.57-11.18)	8.13	(3.49-18.92)
Fever in last two weeks			-		-	
Diarrhoea in last two weeks			-		-	
ARI in last two weeks			5.45	(1.39-21.35)	5.62	(1.95-16.25)
Utilization of services provided by AWC						
Utilization of supplementary nutrition by children					-	
Utilization of RTE food packet by mothers during pregnancy and lactation					-	
Vitamin A supplementation					3.90	(1.43-10.60)

Table 3. showing multivariate analysis of determinants of severe acute malnutrition. 25 variables differed between cases and controls on bivariate analysis ($p<0.05$) as in Table 2. A multivariable model was developed with variables that had different distribution in cases and controls in bivariate analysis ($p<0.05$). The final model (Model 5) explained 63.1% (Nagelkerke R^2) of the variance in the severe acute malnutrition and correctly classified 82.2% of cases.

Among all the variables examined,the final model included large family size, short birth interval, home delivery, low birth weight, deficiency of protein in diet, ARI in last two weeks and not taken full doses of vitamin A (as per age). It shows that after adjusted for other variables the odds of having SAM were 4.23 times higher among children where family size is more than 5 (AOR 4.23, 95% CI 1.66-10.75, p=0.002). Birth interval of <24 months was statistically highly significantly associated with SAM (AOR 6.38, 95% CI 2.74-14.90, p=0.000). Children delivered in home were 3.89 times more likely to develop SAM than children delivered in hospital (AOR 3.89, 95% CI 1.15-13.11, p=0.029). Birth weight <2.5 kg was also found statistically highly significantly associated with SAM (AOR 7.43, 95% CI 2.44-22.60, p=0.000). Deficiency of protein in diet was statistically highly significantly associated with SAM (AOR 8.13, 95 % CI 3.49- 18.92, p=0.000). Children suffered from ARI in last two weeks were 5.62 times more likely to develop SAM than children not suffered from ARI (AOR 5.62, 95% CI 1.95-16.25, p=0.001). Children not taken full

doses of vitamin A (as per age) were 3.90 times more likely to develop SAM than children taken full doses of vitamin A (AOR 3.90, 95 % CI 1.43-10.60, p=0.008).

VI. DISCUSSION-

In this study the household where the family size was greater than five members were an independent determinant for SAM, similar finding was revealed by Ayana AB et al[11] in their study in West Ethiopia where having large family sizes >5 were associated with acute malnutrition. The effect of a large family size with overcrowding and inadequate spacing has been implicated as a risk factor for severe malnutrition in different studies done in Bangladesh, and Nigeria.[12,13]. However an institution-based case control study in India by Mishra K et al[9] did not find large family size as independent risk factor of SAM. Similarly, Pravana NK et al[14] in their study revealed that large family size was not an independent factor of SAM. Birth interval of <24 months was also an independent determinant of SAM in our study which is consistent with the studies done in Nepal, Ethiopia, Bangladesh[14,15,16]. In present study place of delivery was found associated with SAM in multivariate analysis. Low birth weight of child was significantly associated with SAM. In a case control study by S Anoop et al[17] in South India, low birth weight was significantly associated with malnutrition. Another Indian study by Sanghvi U et al[18] in rural Kerala also observed low birth weight as significant risk factor for child malnutrition. An association between low birth weight and subsequent childhood malnutrition is also found in other reviewed studies.[19-24] However in a case control study conducted by Sharghi A et al[25] in Iran, low birth weight was not significantly associated with childhood malnutrition. Deficiency of protein in diet has found statistically significantly associated with SAM in present study. Study in Karnataka by Prashanth MR et al[26]and Wong HJ et al[20] in Malaysia also reveals that deficiency of protein in diet were statistically significant association with malnutrition. However, study done in Nepal by Pravana NK et al[14] showed that deficiency of protein was not statistically significant association with SAM. In our study recent ARI infection has found significantly associated with SAM, however recent fever and diarrhoea infection were not found as risk factor for SAM. Study in Karnataka by Ansuya et al[27] also found recurrent cold and cough as risk factor for malnutrition.In the current study children who received vitamin A supplementation for up to date for their age were 76% and vitamin A supplementation was statistically significantly associated with SAM. According to Bilaspur district NFHS-4 2015-16 finding 79.5% of children of 9-59 months were received a dose of vitamin A in last 6 months.[7] Our finding is slightly lesser than NFHS-4 2015-16 findings. The Children who receive vitamin A were less likely to have acute malnutrition as compared to children who were not supplemented with vitamin A. This might be because vitamin A supplementation reduce the prevalence of diarrhea by boosting the immunity which in turn decreases the risks of acute malnutrition.

VII. CONCLUSION-

In this study, large family size, short birth interval, home delivery, low birth weight, deficiency of protein in diet, ARI in last 2 weeks and incomplete vitamin A supplementation were independent determinants of SAM among children of 6-59 months. Specially designed and innovative reproductive health approach for slum area is needed. An awareness for institutional delivery, family education regarding food supplementation and protein rich diet for pregnant womenis needed. Improving the knowledge and practice of mothers on appropriate infant and young child feeding practices, so they can prepare energy and protein dense locally available low-cost food and feed children according to their need.Improve health care system for early diagnosis and complete treatment of common childhood illnesses like ARI, which is an important co-morbid condition associated with SAM. There is need of increase in faith of community and mothers on services provided by Angan Wadi Centres.

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