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Short Communication

Exposure to second-hand smoke as a risk factor for severe under-nutrition among children less than five years - Results from a community-based case-control study from Kerala, southern India

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ABSTRACT

Background: Under-nutrition among children less than 5 years continues to be a public health problem in India. **Objective:** To identify various risk factors associated with severe under-nutrition among children less than 5 years in Kollam district, Kerala. **Methods:** A community-based case-control study was conducted with 40 severely under-weight children as cases and 80 normal weight children as controls. Mothers' of children were interviewed using a structured questionnaire. Univariate and multivariate analysis for factors associated with severe under-nutrition was done. **Results:** Higher birth order (odds ratio [OR] 11.33 [3.80-38.82]), recurrent respiratory tract illness (OR 10.14 [1.17-88.19]), exposure to second hand smoke (SHS) at house (OR 6.12 [1.76-21.18]), and lower birth weight (LBW) (OR 11.34 [3.31-38.82]) were identified as factors associated with severe under-nutrition among children. **Conclusions:** Higher birth order, recurrent respiratory tract illness, exposure to SHS at house, and LBW were identified as factors associated with severe under-nutrition in this study. Strategies to prevent exposure of children to SHS should be a child health priority.

Key words: *Malnutrition, Second hand smoke, Passive smoking, Children*

About one third of the under-five deaths in the world are attributable to under-nutrition [1]. Under-nutrition among children less than 5 years continues to be a public health problem in India with a prevalence of 43% [2]. Kerala is one of the best performing states as far as child health is concerned with exceptionally good child health indicators [3]. Prevalence of underweight (weight for age below 2 standard deviation [SD]) in Kerala is 20.9% and severe under-weight (below 3 SD) is 6.4% [4].

Childhood malnutrition is influenced by many factors including biological, behavioral, and environmental factors, which may vary in different settings. The current study was undertaken with the objective to identify various risk factors associated with severe under-nutrition among children lesser than 5 years in Kollam district, Kerala.

METHODS

Kollam district located in the south west cost of Kerala has a population of around 2.6 million. Decadal growth rate of Kollam is 1.73 against 4.86 in the state. Sex ratio is 1113 females for 1000 males, and literacy rate for females is 92%. Infant mortality rate is around 10/1000 live births.

A community-based case-control study was designed with cases being children, 12-60 months, weighing below −3 SD for their age, as identified by Integrated Child Development Services (ICDS) project. Two controls were randomly selected per case, who were children weighing more than 1 SD for their age, from same anganwadi area of the cases, matched for age in months (±6 months). Children less than 1 year were excluded. New WHO child growth standards were used for assessing nutritional status.

Taking proportion exposed to second hand smoke (SHS) in children without malnutrition as obtained from previous literature as 25%, with an expected odds ratio (OR) of 3, 80% power, and 95% confidence level and a case to control ratio 1:2, the sample size was calculated as 42 cases and 84 controls.

About 5 out of 17 health blocks were randomly selected and all severely under-weight children in the selected health blocks were included. Children were weighed to confirm the

Table 1: Univariate analysis of factors associated with severe under-weight in children

Characteristics	Categories	Cases N=40 (%)	Controls N=80 (%)	Chi-square P value	Odds ratio (95% CI)
Maternal education	<10th standard	3 (7.5)	02 (2.5)	0.206	3.16 (0.50-19.72)
	≥10th standard	37 (92.5)	78 (97.5)		
Mother's occupation	Working	7 (17.5)	19 (23.8)	0.296	0.68 (0.26-1.78)
	House wife	33 (82.5)	61 (76.2)		
Socioeconomic status	Lower (≤10)	19 (47.5)	25 (31.2)	0.062	1.99 (0.91-4.34)
	Higher (>10)	21 (52.5)	55 (68.8)		
Gender of child	Male	16 (40)	37 (46.2)	0.516	1.29 (0.59-2.78)
	Female	24 (60)	43 (53.7)		
Maternal hemoglobin (g/dl)	<11	11 (27.2)	13 (16.2)	0.114	1.95 (0.78-4.87)
	≥11	29 (72.5)	67 (83.8)		
Maternal illness during pregnancy	Yes	15 (37.5)	18 (22.5)	0.066	2.07 (0.90-4.72)
	No	25 (62.5)	62 (72.5)		
Birth weight (kg)	<2	10 (25)	4 (5)	<0.001	10 (2.79-35.80)
	2-2.5	13 (32.5)	8 (10)	<0.001	6.5 (2.32-18.18)
	≥2.5	17 (42.5)	68 (85)		1 (Reference)
Birth order	2 or more	27 (67.5)	19 (23.8)	<0.001	6.67 (2.88-15.42)
	One	13 (32.5)	61 (76.2)		
Birth interval	≤2 years	10 (37)	5 (26.3)	0.331	1.64 (0.45-5.97)
	>2 years	17 (63)	14 (73.7)		
Exclusive breast feeding	<6 months	22 (55)	46 (57.5)	0.473	0.90 (0.42-1.94)
	6 months	18 (45)	34 (42.5)		
Received 100 IFA during pregnancy	No	3 (7.5)	2 (2.5)	0.206	3.16 (0.50-19.74)
	Yes	37 (92.5)	78 (97.5)		
Immunization status	Partial	3 (7.5)	01 (1.2)	0.107	6.41 (0.64-62.5)
	Full	37 (92.5)	79 (98.8)		
Father's alcoholism	Yes	13 (32.5)	8 (10)	0.003	4.33 (1.62-11.61)
	No	27 (67.5)	72 (90)		
Recurrent respiratory illness	Yes	6 (15)	2 (2.5)	0.016	6.82 (1.32-35.84)
	No	34 (85)	78 (97.5)		
Exposed to passive smoking	Present	25 (62.5)	18 (22.5)	<0.001	5.74 (2.51-13.13)
	Absent	15 (37.5)	62 (77.5)		
Using biomass fuel inside house	Yes	23 (57.5)	36 (45.0)	0.198	1.65 (0.76-3.55)
	No	17 (42.5)	44 (55.0)		
Improved water source at home	Yes	27 (67.5)	62 (77.5)	0.272	1.65 (0.71-3.85)
	No	13 (32.5)	18 (22.5)		

IFA: Iron-folic acid, CI: Confidence interval

nutritional status and weight was recorded using a standard weighing scale, kept on a firm horizontal surface to the nearest 50 g. Mothers' of children were interviewed using a structured and pretested interview questionnaire, at their home, for information about sociodemographic, antenatal, natal, and post-natal factors and environmental factors.

Socioeconomic status was assessed using Modified Kuppuswamy's scale. Information was triangulated with details from mother and child protection card and hospital records. Exposure to SHS at home was defined as the habitual exposure to tobacco combustion products from smoking by child's father or other household member who smokes inside the house. Husband was labelled as alcoholic if he consumed alcohol on more than 3 days in a week in the last month. Recurrent respiratory tract illness was defined as more than six episodes of illness affecting respiratory system in last 1 year, each episode lasts for at least 3 days. Exclusive breast feeding was assessed by two questions which included have your child received any of the following in the first 6 months (plain water/ sweetened water/honey/infant formula/fresh milk/mushy or semi-solid food/any other food other than breast milk) and did

you give your infant any other liquids or foods before your milk came in?

Data analysis was done using SPSS 12.0 for Microsoft windows. Chi-square test was used to test difference between proportions and independent sample t-test was used to compare two means. Univariate analysis for factors associated with severe under nutrition was done, generating OR and 95% confidence intervals. Selected variables were then entered in to a backward conditional logistic regression model and adjusted OR were calculated.

RESULTS

A total of 40 cases and 80 controls were included in the study. The mean±SD age of cases were 26.39±10.45 and that of controls were 30.12±8.91 months (p=0.47). The mean±SD age of mother at birth of child was 25.9±4.15 and 24.2±2.88 for cases and controls, respectively (p=0.013). Mean±SD body mass index of mother's were 25.5±3.16 and 25.7±2.02 in the case and control group, respectively (p=0.459). Sanitary latrine was present in the houses of all cases and controls. About 4 (10%) of cases had not received a single dose of Vitamin A, whereas all controls had received the same. No child had history of measles, malaria tuberculosis, or recurrent diarrhea.

The univariate analysis of factors associated with severe underweight was shown in Table 1, and the final logistic regression model for factors associated with severe underweight were shown in Table 2. Higher birth order (OR 11.33 [3.80-38.82]), recurrent respiratory tract illness (OR 10.14 [1.17-88.19]), exposure to SHS at home (OR 6.12 [1.76-21.18]), and lower birth weight (LBW) (OR 11.34 [3.31-38.82]) were identified as factors associated with severe under-nutrition among children. OR for exposure to passive smoking stratified by birth weight categories were 7.00, 11.21, and 4.64 for <2 kg, 2-2.5 kg, and >2.5 kg, respectively, and MH OR was 5.81.

Table 2: Logistic regression model showing factors associated with severe under-weight in children

Characteristics	p value	Adjusted odds ratio (95% CI)
SES (lower)	0.287	1.93 (0.57-6.51)
Birth order (2 or more)	<0.001	11.33 (3.80-38.82)*
Recurrent respiratory tract illness	0.036	10.14 (1.17-88.19)*
Exposure to passive smoking	0.004	6.12 (1.76-21.18)*
Birth weight<2 kg	0.003	11.34 (3.31-38.82)*
Birth weight 2-2.5 kg	0.474	2.08 (0.28-15.48)
Husband's alcoholism	0.161	2.95 (0.64-13.33)

Variables entered in the model: Maternal age, SES, maternal anemia, maternal illness, birth weight, birth order, father's alcoholism, recurrent respiratory tract illness, exposure to second hand smoke. CI: Confidence interval, SES: Socio-economic status. *p<0.05

DISCUSSION

The present study used a case-control design to assess the risk factors for malnutrition and had limitations of the design including selection, recall, interviewer's bias, and presence of multiple confounders. However, all possible precautions were taken such as standardizing interview schedule and selecting both cases and controls from ICDS roster to minimize the bias. The study did not have enough power to identify many of the risk factors due to a small sample size. Many categorical variables were dichotomized and analyzed for the lack of large sample size.

Many of the socioeconomic factors associated with malnutrition were not statistically significant in this study. This might be due to the matching of cases and controls from same anganwadi area and selecting them from ICDS roster, which might have resulted in similar socioeconomic profiles in both the groups. As seen in other studies, this study demonstrated that frequent respiratory illness was associated with child malnutrition [5]. Malnutrition increases the risk of infection and infections itself contributes to malnutrition [6]. In accordance with other studies, LBW and higher birth order was found to be a risk factor of child malnutrition [7-9].

A study done in rural Indonesia and secondary evidences from India also found out that paternal smoking is associated with an increased risk of child malnutrition [10,11]. Cohen speculated that childhood malnutrition in Bangladesh is associated with paternal smoking and later on evidences were generated to state that money for buying foods to the children were diverted to cigarettes [12,13]. Studies carried out in different sites in India and a few meta-analysis have found out a decrease in birth weight of babies born to mother's exposed to SHS [14-16]. LBW in SHS exposed women may be due to vasoconstriction properties of nicotine, higher fetal carboxy hemoglobin levels, intrauterine hypoxia, reduced delivery of nutrients, and elevation of blood pressure. The 2006 US Surgeon General's report and UK Government SCOTH report and many other studies concluded that passive smoking was a cause of a range of diseases of children, including acute lower respiratory infections [17-19]. A review of 60 research studies found that SHS exposure in the home increased young infants' risks of developing lower respiratory tract infections by 20-50% [17]. Strategies to prevent exposure of children to SHS should be a child health priority.

CONCLUSION

Higher birth order, recurrent respiratory tract illness, exposure to SHS at house, and LBW were identified as factors associated with severe under nutrition in this study. Studies with larger sample sizes, with biological markers for estimation of passive smoking are needed to confirm the findings.

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