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INFLUENCE OF RISK FACTORS ON MALNUTRITION, IN CHILDREN OF ONE TO FIVE YEARS AGE GROUP: A CASE CONTROL STUDY

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ABSTRACT

Introduction: Malnutrition is a global health problem and an estimated forty per cent of the world's severely malnourished under 5 children lives in India. The causes and impact of childhood under nutrition are complex and manifold..In developing countries, particularly where the population is high, hunger and malnutrition are wide spread among the preschool age children .Failure to combat child malnutrition of preschool age reduces potential economic growth of the country because major growth and development domains get matured during this period and failure to attain full potential. The extent of malnutrition can be countered by educating the parents and care takers with respect to basic nutritional requirements of their children and encouraging them to consume locally available low cost nutritious foods.

Methodology: This case control study conducted at a tertiary level teaching hospital in rural setting for a period of 1year from April 2014 to March 2015. Among 200 children enrolled the 100 cases of undernourished children were matched for age and sex with 100 well nourished control group between the age of 1 to 5years attending nutrition clinic of the hospital.. Instituitional Ethical committee approved the study and written Informed consent was obtained from parents. The diagnosis of protein energy malnutrition was made according to the Indian Academy of Paediatrics (IAP) classification. The weight for age of the control group had to be greater than 80% of the standard without oedema.Those children with severe illness were excluded from this study. A thorough history including, socioeconomic status, feeding pattern, including breast feeding and Complementary feeding, nutritional assessment , history of recurrent respiratory tract infections was documented. The anthropometric measurements include height, weight, head circumference and mid-upper arm circumference were recorded. Protein Energy Malnutrition (PEM) based on weight for age (WFA) as per IAP classification for wasting; Height for Age (HFA) for stunting and Weight for Height (WFH) for wasting and obesity as per Waterlow's classification were designed.The demographic and socioeconomic status were indended from ration card. The calorie intake was calculated by 24 hour recall method. Questionnaire based detail collection of data was recorded in excel sheet and was analyzed using Statistical software (SSPS) and interpreted to find out the relevant association, and was expressed as frequency, percentage tables, charts and figures.

Results: Out of the 100 cases studied, 61% were females and 39% were males 70% were born by normal deliveries and 30% by LSCS. 83% belonged to APL class and 17% belonged to BPL. History of IUGR 10 were among cases and 3 were among the controls.

40% had a low birth weight of <2500gms and 60% had birth weight >2500g ,while among the controls studied only 17% had low birth weight and 83% had birth weight>2500g ,67% had grade 1 underweight,28% had grade 2 underweight and 2% had grade 3 under weight. There were none with grade 4 underweight .50% had normal height for age while38% had 1st degree stunting and 12% had 2nd degree stunting. Significant difference between the mean calorie gap and protein gap of cases and controls.10% had no wasting 51%had 1st degree wasting and 35% had grade 2 wasting and 4% had grade3 wasting. Mean MAC of cases were 14.659 and that of the control group was 13.962.This difference was statistically was significant [p value.000]. After doing logistic regression, female sex was found to be a significant risk factor[p value.004] and mothers education above 10th standard[p value.041] and birth weight above 2500g[p value .001] were found to be significant protective factor for malnutrition

Conclusion: Female sex, low birth weight, inadequate calorie and protein intake and, low maternal education were found to be significant risk factors of childhood malnutrition. Low socio economic status, preterm birth, exclusive breast feeding did not seem to have a significant influence on nutrition status

KEYWORDS : Birth weight ,Under nutrition ,Socioeconomic status, Maternal education

INTRODUCTION:

Malnutrition is a condition associated with lack of proper nutrition due to inadequate consumption, poor absorption or excessive loss of nutrients.[1]Nearly 67% of the country's population suffers from malnutrition.Under nutrition along with deficiency of Iron, iodine, vitamin A , Zn and other macro as well as micro nutrients increases the risk of death and disability from diarrhoea, Acute Respiratory Infection (ARI) and vaccine preventable diseases, particularly measles. Conversely diarrhoea, parasite infestation and other child-hood ailments diminish children's ability to utilize the nutrients available in their diet. The most vulnerable period next to infancy is the age of 1to 5yrs. Preschool children constitute about 14% of the Indian population. Under five children are nations wealth as they contributes to nation's vast human resource which need to be developed and nurtured for the country's progress. Nutritional status of preschool children is of paramount importance, since the foundation of life time health, strength and intellectual vitality is laid during that period. [2,3]

Mal nutrition is a global health problem. In developing countries, particularly where the population is high, hunger and malnutrition are wide spread among the preschool age children An estimated forty per cent of the world's severely malnourished under 5 children lives in India. [4,5]

According to NFHS survey, 43 percent children under age of five years are underweight (low weight for age), 48 percent children under five are stunted (low height for age). Wasting is assessed with low weight for height for the standard and amounts to 20 percent children under five years . Over 6 per cent of these belong to a category called Severe Acute Under nutrition or SAM (<-3SD) [6]

The causes and impact of childhood under nutrition are complex and manifold. An individual will experience under nutrition if the appropriate amount or quality of nutrients is not consumed for an extended period of time. The problem is multifaceted, the causes acting singly or in combination with other complex factors like poverty, purchasing power, health care, ignorance on nutrition and health education, female illiteracy, social customs etc. Besides being associated with high rates of mortality and morbidity, it is also an underlying factor in almost one-third to half of all under five deaths due to preventable causes.[7]

A failure to address child malnutrition reduces potential economic growth at the macro level. At the micro level, malnutrition both protein energy malnutrition and micronutrient deficiencies directly affects children's physical and cognitive growth and increases susceptibility to infection and diseases with frequent episodes of illness and longer

recovery period ending up in growth retardation and poor cognitive development. Long term impact on education attainment may occur in correlation with stunting and iron deficiency anaemia. Without adequate care, such children also fail to reach their full potential due to irreversible effects beyond the first two years of life.[8]

The extent of malnutrition can be countered by educating the parents and care takers with respect to basic nutritional requirements of their children and encouraging them to consume locally available low cost nutritious foods and more over there is no tool for development more effective than women empowerment .

So keeping this in mind, the present case-control study was undertaken to identify the quantum of preschool undernutrition and to relate the major risk factors contributing to the development of malnutrition among the under five children.

Identify the risk factors and its association with type and severity of malnutrition in the children 1-5 yrs of age attending pediatric nutrition clinic in a tertiary level teaching hospital in the rural area of south kerala.

METHODOLOGY:

This case control study conducted at a tertiary level teaching hospital in rural setting for a period of 1year from April 2014 to March 2015. After obtaining approval from Institutional Ethical committee, written informed consent was taken from parents. Privacy and confidentiality was maintained throughout the study. The undernourished children (cases) were matched for age and sex with well nourished children (controls) between the age of 1 to 5years attending nutrition clinic of the hospital. The diagnosis of protein energy malnutrition was made according to the IAP classification

Children aged 1-5yrs with protein energy malnutrition, according to the IAP classification were included in the study as cases. Controls included children aged 1-5yrs matched for age and sex to the cases, and admitted in paediatric ward who gave informed consent. The weight for age of the control children had to be greater than 80% of the standard without oedema as per IAP classification. Those children with severe illness were excluded from this study.

Study Sample size constitute of 100 as per the formula

$$n = \frac{2(z\alpha + z\beta)^2 \bar{p}(1-\bar{p})}{\Delta^2}$$

Where $z\alpha = 1.96$, $z_\beta = 0.84$

$$\bar{p} = \frac{Pc+Pt}{2}$$

100 consecutive children attending the nutrition clinic were selected and they were matched with100 well nourished controls of similar age and sex taken from the pediatric ward by simple random sampling. After obtaining Informed consent from parents a thorough history including, socioeconomic status, feeding pattern, including breast feeding and complementary feeding practices, nutritional assessment of children, history of recurrent respiratory tract infections was recorded. The anthropometric measurements include height, weight, head circumference and mid-upper arm circumference were taken. The child was weighted in kilograms (corrected to the nearest decimal) without slippers and minimally clothed,respecting the modesty of the individual .Height was measured in standing position for children more than 2yrs and for those below 2 yrs length is calibrated in supine position. A surgical measuring tape was used to measure the mid upper arm circumference, which was taken as the point midway between the acromian process of the scapula and the olecranon process at the elbow joint of left upper limb and the reading was corrected to the nearest decimal point Children were classified as having Protein Energy Malnutrition (PEM),based on weight for age (WFA) as per IAP classification .They were classified into groups for 'Height for Age' (HFA) as per Waterlow's classification for stunting. They were also be classified as per based on 'Weight for Height' (WFH) Waterlow's classification for wasting and obesity.The demographic and socioeconomic status was recorded.The child was classified as 'Above or Below the Poverty Line' as per their eligibility for the 'ration card' The calorie intake was calculated by 24 hour recall method ; Questionnaire based data compilation was done and was analyzed and interpreted to find out the relevant association, data was recorded in excel sheet and analysed using Statistical software (SSPS) and was expressed as frequency, percentage tables, charts and figures.

RESULTS:

Two hundred children were studied, of which 100 were undernourished cases and 100 were well nourished controls. Apart from nutrition status, and area of residence, the two groups were similar. The mean age and height of study group and control group were comparable. The mean age of cases were found to be 2.865 and that of controls were 3.090.Out of the 100 cases studied, 61% were females and 39% were males. Among the controls 42% were males and 58% were females. The percentage of females were found to be higher among those with undernutrition.

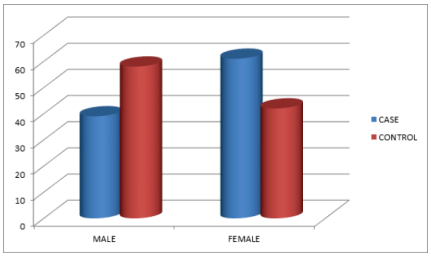

Fig1: Distribution of under nutrition according to gender in case and control

Among the 100 cases 70% were born by normal deliveries and 30% by LSCS.71% of the controls were born by normal delivery and 29% were born by LSCS.

Table11. Distribution of under nutrition according to delivery in case		
DELIVERY	FREQUENCY	%
NORMAL	71	71
LSCS	29	29

Table 12. Distribution of under nutrition according to delivery in control		
DELIVERY	FREQUENCY	%
NORMAL	70	70
LSCS	30	30

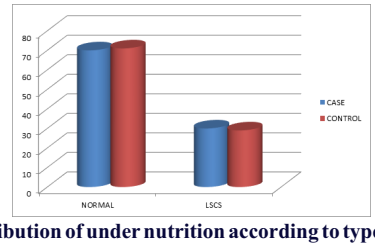

Fig2 : Distribution of under nutrition according to type of delivery

Among the 100 cases studied, 83% belonged to APL class and 17% belonged to BPL. Among the 100 controls studied,90% were APL and 10% were BPL.

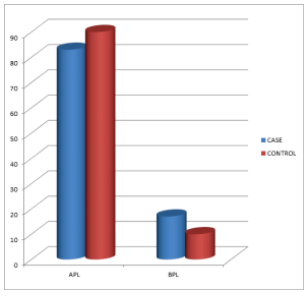

Fig 3Distribution of children according to social class and PEM

There were 13 children with a history of IUGR out of which ,10 were among cases and 3 were among the controls.

Table 13Distribution of children according to IUGR and PEM			
	CASE/CONTROL		TOTAL
	CASE	CONTROL	
IUGR	10	3	13
NO IUGR	90	97	187
TOTAL	100	100	200

Among the children studied there was only 7 who were born preterm out of which 5 were among the cases and 2 were among the controls

Table 14 Distribution of children according to PREMATURITY and PEM

TERM/PRETERM	CASE/CONTROL		TOTAL
	CASE	CONTROL	
PRETERM	5	2	7
TERM	95	98	193
TOTAL	100	100	200

Among the 100 cases studied 40% had a low birth weight of <2500gms and 60% had birth weight o>2500g while among the controls studied only 17% had low birth weight and 83% had birth weight>2500g

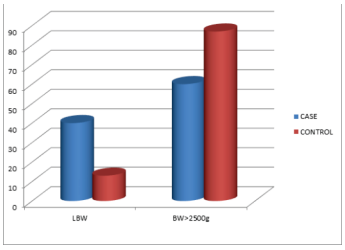

Fig 5 Distribution of under nutrition according to birth weight

Of the 100 cases studied mothers education was <10th standard in 31% whereas among the controls only 21% of the children's mothers were educated <10th standard.

Table 15 Distribution of under nutrition according to maternal education

MOTHER'S EDUCATION	CASE/CONTROL		TOTAL
	CASE	CONTROL	
UPTO 10TH	31	21	52
>10TH	69	79	148
TOTAL	100	100	200

In our study, female sex was found to be a risk factor[odds ratio 2.160,95% confidence interval 1.228-3.800] and birth weight of >2500g was found to be a protective factor for under nutrition[odds ratio .307,95% confidence interval.159-.593].

Mother's education below 10th standard[odds ratio .592,and 95% confidence intervals.312-1.123], preterm birth[odds ratio 1.049,and 95% confidence intervals.571-1.927] ,history of IUGR[odds ratio 3.593 and 95% confidence intervals.958-13.472],low socioeconomic class[odds ratio .542,and 95% confidence intervals.235-1.252], and lack of exclusive breast feeding[odds ratio 1.336,and 95% confidence intervals.311-5.733]was not found to be significant risk factors in our study.

After doing logistic regression, female sex was found to be a significant risk factor[p value.004] and mothers education above 10th standard[p value.041] and birth weight above 2500g[p value .001] were found to be significant protective factor for malnutrition

Table 16 **adjusted odds ratios of risk factors for childhood malnutrition: a case control study**

FACTORS	P VALUE	ODDS RATIO	95%CONFIDENCE INTERVAL
SEX	.004	2.433	1.323-4.472
IUGR	.600	1.512	.323-7.09
PRETERM BABY	.906	.890	.130-6.094
LOW SOCIOECONOMIC STATUS	.414	.684	.275-1.702
MOTHERS EDUCATION	.041	.484	.242-.969
EXCLUSIVE BREAST FEEDING	.697	1.336	.311-5.733
LOW BIRTH WEIGHT	.001	.273	.128-.582
TYPE OF DELIVERY	.914	1.037	.534-2.012

In our study it was found that there was significant difference between the mean calorie gap and protein gap of cases and controls

Table 17 **Distribution according to dietary intake**

Mean dietary intake	Cases	Controls	P value
Calorie	349.4190	39.6500	0.000
Protein	1.8719000	.7070000	0.000

Among the 100 cases studied, 67% had grade 1 underweight,28% had grade 2 underweight and 2% had grade 3 underweight.there were none with grade 4 underweight .

Table 18
Distribution of cases according to grades of PEM

Grade	Frequency	%
Grade 1	67	67
Grade 2	28	28
Grade 3	2	2
Grade 4	0	0

Among the cases 50% had normal height for age while38% had 1st degree stunting and 12% had 2nd degree stunting.

Table 19 **Distribution of cases according to degrees of stunting**

Degree of stunting	Frequency	%
Normal	50	50
1st degree stunting	38	38
2nd degree stunting	12	12
3nd degree stunting	0	0

Among the 100 cases 10% had no wasting51%had 1st degree wasting and 35% hadgrade 2 wasting and 4% had grade3 wasting

Table 20 **Distribution of cases according to degrees of wasting.**

Grade of wasting	Frequency	%
No wasting	10	10
Grade 1	51	51
Grade 2	35	35
Grade 3	4	4

The mean MAC of cases were 14.659 and that of the control group was 13.962.This difference was statistically was significant [p value.000]

Table 21 mean mid arm circumference among cases and controls

s	CASE	CONTROL
Mean MAC	14.659	13.962

DISCUSSION:

In this case control study we analyzed the significance of risk factors on outcome of malnutrition among children in 1to 5 years .We compared the socio-demographic and nutritional characteristics of 100 undernourished children with 100 well nourished children.It was found that larger proportion of females were suffering malnutrition as compared to males. In a study conducted in Aligarh by Sharma et al, it was found that most females were suffering from PEM as compared to males[9]Similar study done in Hissar District shows that grade I PEM was more common in boys than girls but grade II and IIIPEM was significantly more in girls than boys ($p < 0.01$)[10]. In another study conducted in urban slum of Delhi, it was found that there was significant difference among male and female with respect to malnutrition with more females (9.6%) suffering from severe malnutrition as compared to male (6.5%)[11]

As per the study, more children of illiterate mother were malnourished as compared to children of literate mother. Study done in Chandigarh shows that, with increase in educational status of parents, the prevalence of PEM was steadily and significantly decreases ($p<0.001$)[12] Similar result that the prevalence of PEM among children decreased with increasing mother's literacy was reported by NFHS-III (2005-06)5 and Singh et al. (2012)7 Another study done in Kanpur shows that mother education has got statistically significant influence on the nutritional status of the children[13]

When compared with the recommended dietary intake[ICMR], the dietary intakes of cases were inadequate in calorie and protein. This is similar to the findings of the study done by Wong et al. Similar finding was reported among malnourished children in Kelantan, Malaysia [15]. It was found that many of the cases had low intake of fruits, green-leafy vegetables, milk and dairy products, but consumed more unhealthy snacks and sweet drinks. staple foods especially rice. The low calorie intake could be due to poor access to food, poor feeding practices and frequent illness[15].

The study showed higher proportion of underweight among low birth weight Study done by Shreyaswi et al showed that the prevalence of under nutrition was higher among the children born with low birth weight ,with 18 (75%) being undernourished among the low birth weight compared to 66 (60.6%) of 109 normal birth weight children.In accordance with other studies [15,16,17,18], low birth weight was found to be a risk factor of child malnutrition

Socio economic status was not found to be a significant predictor of childhood malnutrition, which was similarly reported in other studies [19,20]. It was found that a significant proportion of malnourished children came from non-poor families. Similar results were reported by several studies in Malaysia [14-15].This may be because majority of the people visiting the institute belonged to middle or upper class
A majority of 193 (96%) children among the survey population were born mature or term while 7(4%) were born premature. Among those born premature, majority had malnutrition but this difference was not statistically significant. Similar finding was obtained in study done by Shreyaswi et al.[8]

This study did not find any significant associations between children's nutritional status with breast feeding and the time of initiation of complementary feeding . This was probably due to the widespread breast feeding practices among the people coming to this center. Similar findings were reported in studies by Menon et al[21] and Cheah et al[22].

CONCLUSION:

In this case control study of 100 cases we have explored the socio-economic risk factors for malnutrition in children attending nutrition clinic of tertiary level teaching hospital of rural setting. Female sex, low birth weight, inadequate calorie and protein intake and, low maternal education were found to be significant risk factors of childhood malnutrition. Low socio economic status, preterm birth, exclusive breast feeding did not seem to have a significant influence on nutritional status. Among the cases 67% had grade 1 underweight,28% had grade 2 underweight , 2% had grade 3 underweight and none with grade 4 underweight; 50% had normal height for age while 38% had 1st degree stunting and 12% had 2nd degree stunting. 10% had no wasting 51% had 1st degree wasting and 35% had grade 2 wasting and 4% had grade 3 wasting. Improvement in female literacy and empowerment will definitely reduce the risk of under five malnutrition,

Limitations of the study : We didn't find any significant association between children's nutritional status and time of complimentary feeding.this could be due to widespread breast feeding practices among the people of kerala and the majority of population that benefit health care from our institute is from upper class and upper middle class.

Conflict of interest: None declared

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