CONSANGUINITY AMONG THE RISK FACTORS FOR UNDERWEIGHT IN CHILDREN UNDER FIVE: A STUDY FROM RURAL SINDH

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Background: Malnutrition is a common problem, especially in developing countries. Of the 11 million children under 5 who die each year in the developing countries mainly from preventable causes, the death of about 54% are either directly or indirectly attributable to malnutrition. The objectives of this study were to assess the prevalence and associated factors for underweight in rural Sindh. **Methods:** A cross-sectional survey was conducted in Jhangara Town, located in District Dadu, Sindh. Eight hundred children under 5 years of age were enrolled. A questionnaire was used to elicit required information and anthropometric measurements were made. **Results:** The overall prevalence for underweight was 54.3% in the study population, which was higher than the prevalence reported by PDHS 1990–91. In multivariate analysis, various factors for underweight were consanguinity (OR=1.5, 95% CI=1.08–2.07), low birth weight (parents' perspective) (OR=1.6, 95% CI=1.08–2.16) and lack of breast-feeding (OR=2.7, 95% CI=1.19–6.17). **Conclusion:** Effective strategies to discourage consanguineous marriages between first cousins are required. Promoting breast feeding is another factor that should be incorporated while designing control strategies to reduce morbidity and mortality due to malnutrition in children (<5 years).

Keywords: Underweight, Consanguinity, Children, under 5 years

INTRODUCTION

Adequate nutrition is essential for proper growth and physical development from conception to adulthood to ensure optimal working capacity, normal reproductive performance and adequacy of immune mechanism which provides resistance to infections.[1] Under-nourishment due to protein energy malnutrition significantly increases susceptibility to major infectious diseases in low-income countries, particularly in children.[2–4] Malnutrition is responsible, directly or indirectly, for 54% of the 10.8 million deaths per year in children under 5 and contributes to every second death (53%) associated with infectious diseases among children under 5 years of age in developing countries.[2,5]

Throughout the developing world, 1 out of every 4 children–roughly 146 million children–under the age of 5 is underweight.[6] The highest levels of underweight prevalence are found in South Asia, where almost half (46%) of all children under 5 are underweight, followed by Sub-Saharan Africa, with more than one-quarter (28%) of all children under 5 being underweight. Three countries in South Asia–India, Bangladesh and Pakistan–home to merely 29% of the emerging world's under-five population, accommodate 50% of the world's underweight children.[7]

Undernourished children who survive the early years of childhood frequently have low levels of iron, iodine, protein and energy, which can contribute to chronic sickness, stunting or reduced height for age, and impaired social and cognitive development.[6] There is convincing evidence that impaired growth is associated with delayed mental development, poor school performance, and reduced intellectual capacity.[8–11]

Malnutrition stems from a number of causes but at most immediate level it occurs as a consequence of inadequate dietary intake and disease, which usually occur in combination. However, a number of cultural and economic elements are also involved.[12]

Child growth is internationally recognised as an important public health indicator for monitoring nutritional status and health in populations. A number of studies have established the association between increasing severity of anthropometric deficits and mortality.[11]

Of the various anthropometric indices that can be used to assess child growth status, three are more widely used: height-for-age portrays performance in terms of linear growth, and essentially measures long-term growth faltering (stunting); weight-for-height reflects body proportion, or the harmony of growth, and is particularly sensitive to acute growth disturbances (wasting); and weight-for-age represents a convenient synthesis of both linear growth and body proportion (underweight).[13] In this study, we will only be focusing on underweight as an indicator of malnutrition in our study population.

Global prevalence for moderate and severe (<-2SD) underweight, is reported as 25%, and the percentage is higher for developing countries (27%).[6] Pakistan Demographic and Health Survey (1990–91), examining the nutritional status of children (<5 years), revealed that 40% children are underweight (as compared to NCHS standard).[14] The Pakistan National Nutrition Survey (1985–87) showed similar results.[15] A National Nutrition Survey conducted during 2001–2002 indicated that about 38% of the children between the ages of 6 months and 5 years are under weight.

The aetiology of malnutrition is complex and multi-factorial. Factors reported in various studies include initiation of breast feeding and improper weaning[16], incomplete vaccination[17], large family size[18], low birth weight[19], maternal education and birth interval[20].

The objective of this study was to a) determine the prevalence of underweight among children under the age of five years; and b) assess factors associated with child nutrition in our population particularly consanguinity, prolonged breast feeding and birth interval, apart from the other documented socio-demographic risk factors related with malnutrition.

MATERIALS AND METHODS

A cross sectional design was followed to carry out the study. This study was conducted in Jhangara Town, located in district Dadu, rural Sindh which is 15 km away from Sehwan Sharif and 320 km from Karachi. The area is inhabited by Sindhi speaking Muslims, most of them being farmers and labourers; majority of the population was illiterate.

The total sample size was calculated as 692 at least, with a power of 90%, at a 95% confidence level (two sided) which can easily detect an odds ratio of at least 2, provided that the prevalence of various risk factors in the source population is between 15–75%.[21]

A total of 800 children less than five years of age were enrolled for the study giving an allowance of 15% for both expected refusal and incomplete information. (A census was conducted as the total number of children in the study site was around 800).

The inclusion criteria included enrolment of those children who were under five years of age, that is, the child had not celebrated his/her fifth birthday at the time of interview. The selection of the child was irrespective of ethnicity, religion and gender. Only the last born child of the family who was under five years of age was enrolled. If a person had more than one wife, then the youngest child of either of the wife was enrolled; if a person had twins, then one child was selected randomly. The couples who had an adopted child or stepchild (for either of the parents) were excluded from the study. Similarly, children with congenital deformities were also excluded.

A questionnaire was designed to elicit information from respondents with precision. The interviewers were trained based on the manual of instructions. Protocol for anthropometric measurements was physically demonstrated on children during the training sessions.[22]

The anthropometric measurements were converted into weight for age index. To calculate the anthropometric index, the information regarding the child that is, age (months), sex, weight (kg) and height/ length (cm), was entered into nutritional anthropometric program in EpiInfo. These indices were then expressed as Z-scores relative to the international [National Centre for Health Statistics (NCHS)]/Centre for disease control and prevention/World Health Organization] reference population. A child's nutritional status was then categorized by his/her Z-score. Children were defined as underweight if the Z score was more than two standard deviations (2 SD) below the reference median (NCHS) on the basis of weight for age.

Descriptive analysis was followed by univariate (OR 95% CI) and finally multivariate analysis was conducted to control for the confounding. SPSS Package version 7.5 was used for analysis.

RESULTS

The descriptive results are based on 800 records. Out of 800 records, 6 records were flagged (based on nutritional anthropometry package). Flagging occurs when the value for indices becomes out of range which happens due to incorrect measurements.

Descriptive results showed that 56.3% of the study populations were boys where as 43.6% were girls. The mean age of boys was 25.34±16.48 months while mean age of girls was 25.75±15.90 months. Regarding consanguinity among the parents, majority of the marriages were consanguineous (53.8%) while 33.6% were not consanguineous; 7.3% were unaware, i.e., unable to figure out about the consanguinity and 5.7% gave no response (Table-1). The results of the whole study population showed that overall 54.3% of the children were underweight (Table-2).

In univariate analysis consanguinity was dichotomized as couples who were first cousins (labelled as consanguineous) and those who were not first cousins.

Consanguinity was identified as a risk factor for underweight. Children who were underweight were 1.5 times more likely to have consanguineous parents compared to normal children (OR=1.5, 95% CI 1.08–2.01) (Table-3).

To assess the impact of low birth weight on child's nutritional status, we needed the accurate birth weight which was very difficult to get in that community. Therefore, we, instead, asked the parents about the appearance of the child at the time of birth, that is, whether the child looked normal or underweight (low birth weight). This was used as a proxy for low birth weight. It was found that the child who had low birth weight was 1.5 times more likely to be underweight as compared to those who were of normal birth weight (OR=1.5, 95% CI 1.05–2.06) (Table-3).

To see the relationship between breast feeding and nutritional status, it was found that the children who were underweight were 3.2 times more likely to be fed on non-breast milk compared to normal children (OR=3.2, 95% CI 1.40–8.20). Duration of breastfeeding did not significantly affect the child's underweight status. Other variables studied included gender, weaning age, parents' education, and birth interval. The univariate analyses of these were insignificant (Table-3).

After sorting for multicollinearity, different possible subsets were tried and the model was formed with the variables: consanguinity, birth weight and breast feeding. Various possible interactions were tested, for example, consanguinity and birth weight; consanguinity and breast feeding; but none of these were identified as significant according to p-value criteria of Wald statistics.

Consanguinity was identified as a risk factor for underweight, showing that couples who were first cousins were 1.5 times more likely to have an underweight child as compared to those couples who were not first cousins. (OR 1.5, 95% CI 1.08–2.07)

Child appearance at the time of birth was used as a proxy for the birth weight. Low birth weight was identified as a risk factor in multivariate model showing that the children who were of low birth weight were 1.6 times more likely to be underweight as compared to those children who had normal birth weight (OR=1.6, 95% CI 1.08–2.16).

In this study, lack of breast feeding was identified as a risk factor for malnutrition. Children who were fed on non-breast milk were 2.7 times more likely to be underweight as compared to those children who were fed on breast milk (OR=2.7, 95% CI 1.19–6.17) (Table-4).

Table-1: Percentage Distribution of various factors of study population n=800

Factor	n	%
Gender		
Male	450	56.3
Female	350	43.8
Breast Feeding History		
Yes	763	95.4
No	87	4.6
Birth Weight		
Known	15	1.9
Not-Known	785	98.1
Birth Weight in Parent's Perspective		
Normal	452	56.5
Under weight	227	28.4
Don't know	121	15.1
Consanguinity		
Yes	430	53.8
No	269	33.6
Don't Know	58	7.3
No response	43	5.4
	Mean	**SD**
Boy's Age (in months)	25.34	16.48
Girl's Age (in months)	25.75	15.90

Table-2: Prevalence (Percentage) of Underweight by Age (in months) in Whole Study Population

Age (Months)	Children Evaluated	Underweight	
		n	%
Age≤6	84	46	54.8
6<Age≤12	191	108	56.5
12<Age≤24	205	128	62.4
24<Age≤36	165	89	53.9
36<Age≤48	92	40	43.5
48<Age<60	57	20	35.1
All 0<Age<60	794	431	54.3

Table-3: Percentage Distribution of Selected Risk Factors by Status of the Child in Study Population (n=794)

		Status of the Child					
		Normal		Underweight			
	Risk Factor	n	%	n	%	OR	95% CI
Gender	Boys	206	56.7	240	55.7	1	0.78–1.40
	Girls	157	43.3	191	44.3	1.04	
Birth weight (parents peers.)	Normal	227	70.9	221	62.4	1	1.05–2.06
	Underweight	93	29.1	133	37.6	1.5	
Breast feeding (history)	Yes	355	97.8	402	93.3	1	1.40–8.20
	No	8	2.2	29	6.7	3.2	
Breast feeding (duration)	up to 12 months	103	37.2	146	45.2	1	0.51–1.01
	>12 months	174	62.8	177	54.8	0.72	
Weaning Age	≤6 months	119	87.4	145	39.7	1	0.66–1.25
	>6 months	199	62.6	220	60.3	0.9	
Fathers' Education	Literate	142	39.1	168	39.0	1	0.75–1.35
	Illiterate	221	60.9	263	61.0	1	
Mothers' Education	Literate	24	6.6	20	4.6	1	0.76–2.83
	Illiterate	339	93.4	411	95.4	1.4	
Consanguinity	Not related	165	50.6	159	41.0	1	1.08–2.01
	Related	161	49.4	229	59.0	1.5	
Birth interval	≥24 months	225	62.0	248	57.5	1	0.90–1.62
	<24 months	138	38.0	183	42.5	1.2	

Table-4: Final Regression Model for Underweight

Risk Factors	Coefficient (SE)	Adjusted OR	95% CI	*p*-Value
Consanguinity				
No		(ref)		
Yes	0.403 (0.165)	1.5	1.08–2.07	0.01
Birth weight (Parents perspective)				
Normal		(ref)		
Under weight	0.426 (0.175)	1.6	1.08–2.16	0.01
Breast feeding				
Yes		(ref)		
No	0.997 (0.420)	2.7	1.19–6.17	0.01

Constant: -0.301 (0.139)

DISCUSSION

Overall, the prevalence of underweight in our study from a rural area of Pakistan was 54.3% and the factors associated included consanguinity, low birth weight and lack of breast feeding. The figures we report for underweight in children (<5 years) are higher than those reported for rural areas in the last Demographic Health Survey in Pakistan (44.6%).[14] Results from WHO studies over the period of 1998–2005 (the period after our data was collected) show an improvement in this parameter (38%).[6] This probably indicates the benefits of investing in child health programs, such as IMCI (Integrated management of Childhood Illnesses) which incorporate nutritional counselling as well. However, as statistics regarding most rural areas is under-reported, WHO figures may be an over-estimation of the real situation.

Similar studies from Bangladesh[19] and India[23] report lower national prevalence for underweight 48% and 16% (for children under 3), respectively.

It was not unusual to observe a high prevalence of malnutrition in our study as our study population of Jhangara belongs to low socio-economic strata with minimal health facilities, sanitation, illiteracy and lack of infrastructure. These features do contribute to the poor nutritional status of the children in the community.

In our study, the prevalence of underweight showed a maximum value in the second year (62.4%) and then decreased gradually. Similar patterns have been observed in other studies.[16,24] During the fifth year, however, prevalence of underweight dropped suddenly from 43.5% to 35.1% which we found to be unusual. We checked the Z-score calculations and looked for interviewer bias. The element of chance, age misclassification or unreported age specific growth behaviour may be responsible for this finding.

Various risk factors for underweight were identified. The relationship between prolonged breast feeding and malnutrition has been discussed in some studies.[16,17,19] In our study, lack of breast feeding was identified as a risk factor for underweight. The prevalence of ever breast feeding for the last born child in this study was 95%. An earlier survey in Pakistan, five years preceding ours, has reported that the prevalence of ever breastfed children was 94% in rural areas.[14] It is universally accepted that breast feeding plays an important role in child growth and nutrition as it protects against morbidity and mortality from infectious diseases.[25] Dinesh *et al* concluded from their study in India that delayed initiation of breastfeeding, deprivation from colostrum, and improper complementary feeding were significant risk factors of underweight children.[16] In the rural community, breast feeding is much more practiced, which is evident from our study. However, according to the last conducted National Nutrition Survey 2000–01, the percentage of exclusive breastfeeding decreases from 73% in the first month to 50% in six months in our population.[26]

Present study showed that parental consanguinity was associated with the child being underweight. Various studies conducted in Pakistan have shown that around two-third (66%) of marriages are consanguineous, 80% of these being among first cousins.[27,28] In the rural set-up, consanguinity is practiced even more, as it is thought to preserve social structure in terms of ethnic and tribal affiliation.[29] Previous studies have looked at the effect of consanguineous marriages on reproductive behaviour and child mortality.[30–33] Consanguinity has been shown to increase the risk of congenital anomalies and infant mortality in Pakistan, the relative risk of infant mortality varying between 1.4 and 1.8 for consanguineous compared to non consanguineous marriages.[34,35] Consanguineous marriages also increase the risk of intrauterine growth retardation.[36] All these consequences of consanguinity predispose a child to poor growth later on.

We took the parents perspective of child appearance at the time of birth as a proxy for birth weight. This has been done in other studies of the region[16], as most children are not weighed at the time of birth. With this criteria, 28.4% of the parents reported that their child was under weight (low birth weight) at the time of birth. Low birth weight was identified as a risk factor for underweight. This result is consistent with the findings of other studies which have shown that low birth weight (<2500 g) is a risk factor for malnutrition[36,37] as birth weight influences growth during infancy.[38] Rayhan *et al*,[19] in a study conducted in Bangladesh, report that babies small in size were around three times more at risk of being underweight compared to their average sized counterparts. Low birth weight could be due to poor antenatal care secondary to paucity of health services in our area.[39] A study of three regions–Latin America and the Caribbean, South Asia and sub-Saharan Africa–conducted by the International

Food Policy Research Institute, stated that where women have a low status and no say in household decisions, they are more likely to be undernourished themselves and less likely to have access to resources that they can direct towards children's nutrition.[40] In South Asia, where between 40% and 60% of women are underweight the incidence of underweight births is highest in the world (45% in 2005). The same study concluded that if men and women had equal authority in decision making, the incidence of underweight children less than three years in South Asia could fall by up to 13 percentage points, resulting in 13.4 million fewer undernourished children.[6,40]

Every study has its limitations. In our case, a follow up study design would have been better to assess the nutritional status of the children. The effect of both environmental and genetic factors is expected to have been obscured as children from most affected (e.g., most socially deprived) families, who happened to be most malnourished, had already passed away. This created a built-in bias in the study because only the children who were alive were enrolled. As we conducted our study in a rural population with high illiteracy, we expect increased problems of recall; inaccurate responses in variables such as child age and birth interval may have affected the results of the study. To improve the quality of the data, however, interviewers were trained to use local events and Islamic calendar to get as precise a response as possible.

CONCLUSION

Major findings of this study were regarding consanguinity, low birth weight and the effect of breast feeding. Based on the results of this study, we recommend breast feeding should be promoted and consanguineous marriages between first cousins should be discouraged through counselling at the household level by lady health workers.

Women's nutrition should be prioritised. This should include improving access of health care services and nutrition counselling to women through lady health workers and raising awareness among women, encouraging them to take active steps to improve their own and hence their child's nutritional status as well.

Community based nutrition programs are needed as a direct means of improving nutrition, and as a concrete focus for nutritional concerns and policies. Without these, interest in nutrition has not been sustained, and most countries with improving nutrition have such programs.

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