Original article

Birth Interval and Birth Order Relationship with Undernutrition among Children Under-Five: A Hospital-Based Cross-Sectional Study

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ABSTRACT

Background: Birth spacing and birth order are significant factors affecting child health and nutritional status but it is often overlooked when dealing with child undernutrition. There remains a need to consider the modifiable risk factors for undernutrition among children. Therefore, this study aimed to find the relationship of preceding birth interval and birth order with undernutrition among children under five years of age.

Subjects and methods: The cross-sectional analytical study included 133 pairs of mothers and children who attended Sir Ganga Ram Hospital, Lahore, Pakistan from July to September 2023. Interviewer administered close-ended questionnaire used to collect data (characteristics of index children and their mothers). Children were categorized into well-nourished and undernourished (wasted, stunted or underweight) using the WHO standards for child growth. Crosstabs and binary logistic regression analysis were done to find the relationship between preceding birth interval, birth order and nutritional status.

Results: With 67 (50.4%) boys and 66 (49.6%) girls, the mean age of children was 17.9±12.7 (range 6-59 months). Among 94 (70.7%) undernourished children, 80 (85.1%) had all three indicators of undernutrition (wasting, stunting, and underweight). Birth order of the index child, age of child, family income and mother's BMI showed significant association with childhood undernutrition (all p-values ≤0.05). Whereas preceding birth interval, contraception knowledge and practices were not related to childhood undernutrition (all p-values >0.05).

Conclusion: The child's birth order, age, family income, and maternal BMI showed significant association and greater risk of undernutrition; however preceding birth interval was not related with undernutrition among children under five. Limiting the number of births and improving maternal health and nutrition may reduce child malnutrition.

Keywords: Nutritional status, birth order, birth spacing, children under 5 years

INTRODUCTION

Malnutrition with an estimated 149.0 million cases of stunting, 45.0 million of wasting and 38.9 million of overweight or obese, is a global health problem among children (<5 years).[1] Early childhood malnutrition has severe and irreversible consequences with long-lasting effects on later life.[2] Child undernutrition is largely preventable, though it is quite difficult to control as multiple interrelated factors are responsible for it.[2-4] According to the National Nutritional Survey 2018 in Pakistan, 40.2% of children (<5 years) were stunted, 17.7% were wasted, and 28.9% were underweight. Moreover, 14.4% women of reproductive age were undernourished, and 37.8% were overweight or obese.[3] As maternal health characteristics are related to child well-being,[5,6] there remains a need to investigate the modifiable risk factors for undernutrition among children.

According to the World Health Organization (WHO) report, a period of at least 24 months is an optimum birth-to-pregnancy interval and an optimum birth-to-birth interval is of at least 33 months.[7] Suboptimal birth spacing and repeated childbirths deplete mothers' nutritional reserves and increase the risk for intrauterine growth restriction, low birth weight, and preterm labour.[8] It is reported that children conceived after 12-17 months intervals have a 27% higher risk of being stunted and a 23% higher risk of being underweight than those conceived after 36-47 months intervals.[9] Hence, birth spacing and birth order are significant factors affecting child health and nutritional status. Similar research work was lacking from Pakistan. Therefore, the present study aimed to find the relationship of preceding birth interval and birth order with undernutrition among children under five.

Conflict of interest: The authors declared no conflict of interest exists.

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SUBJECTS AND METHODS

The cross-sectional analytical study was performed at Outpatient Department of Social and Preventive Paediatrics, Sir Ganga Ram Hospital, Lahore, Pakistan. Total 133 pairs of mothers and children who attended the hospital from July to September 2023 were enrolled using the convenience sampling technique. The sample size was calculated using the expected prevalence of stunting 27.9% in children with preceding birth interval ≤ 24 months,[10] with 95% confidence level and 8% margin of error.

The inclusion criteria were children aged 6-59 months, of any gender, and their mothers. Index children having any comorbid chronic condition such as congenital heart disease, hepatitis, tuberculosis, or diabetes; having no elder sibling; taking treatment/ supplements for growth; or cases with missing information were excluded from the study.

Using an interviewer administered close-ended questionnaire, data (characteristics of index children and their mothers) were collected upon enrollment in the study. The characteristics of mothers including age, education, family income, body mass index (BMI), number of children, and contraception knowledge and practices were noted. In addition, the characteristics of index children including age, gender, number of siblings, birth order, and preceding birth interval were noted. Birth interval calculated as the time interval between current live birth and preceding live birth. According to the WHO recommendations, a preceding birth interval of 33 months or more was considered as the optimal birth interval.[7] The weight-for-height Z score (WHZ), height-for-age Z score (HAZ) and weight-for-age Z score (WAZ) were calculated and childhood undernutrition was assessed using the WHO standards for child growth. A child who had HAZ less than 2.0 SD defined as a case of stunting; who had WHZ less than 2.0 SD defined as a case of wasting; and who had WAZ less than 2.0 SD defined as a case of underweight.[11]

Based on their nutritional status, all children were categorized into two groups, (1) well-nourished children, and (2) undernourished children. Then, all continuous variables were categorized into groups as follows: maternal age ≤30 vs. >30 years; BMI 18.5-24.9 Kg/m^2 vs. others; family income >25000 vs. ≤25000 PKR/month; index child's age >24 vs. ≤24 months; number of siblings ≤3 vs. >3; birth order others vs. 2; birth order others vs. 3; birth order others vs. 4; birth order others vs. ≥5; birth interval others vs. <12 months; birth interval others vs. 12-23 months; birth interval others vs. 24-33 months; and birth interval others vs. >33 months.

Statistical Package for Social Sciences (SPSS) version 26.0 used for entry and analysis of data. Crosstabs analysis performed to compute odds ratio (OR) with 95% confidence interval. Chi square test used to compare the proportions between well-nourished and undernourished children. Binary logistic regression analysis performed to compute adjusted odds ratio (aOR) with 95% confidence interval. The covariates were index children age, gender, number of siblings, birth order 3, birth order 4, birth order ≥5, birth interval <12, birth interval 12-23, birth interval 24-33, maternal age, BMI, education, occupation, family income, and contraception knowledge & practices. The dependent variable was the nutritional status of children. A p-value of ≤0.05 was taken as significant.

Table 1: Characteristics of well-nourished and undernourished children under-five

Characteristics	Total children (n=133)		Well-nourished children (n=39)		Undernourished children (n=94)	
	Count	Column %	Count	Column %	Count	Column %
Age (months)						
>24	26	19.5%	16	41%	10	10.6%
≤24	107	80.5%	23	59%	84	89.4%
Sex						
Male	67	50.4%	20	51.3%	47	50%
Female	66	49.6%	19	48.7%	47	50%
Number of siblings						
≤03	92	69.2%	29	74.4%	63	67%
>03	41	30.8%	10	25.6%	31	33%
Birth order of index child						
<05	114	85.7%	38	97.4%	76	80.9%
≥05	19	14.3%	01	2.6%	18	19.1%
Preceding birth interval (months)						
≥33	30	22.6%	07	17.9%	23	24.5%
<33	103	77.4%	32	82.1%	71	75.5%

Table 2: Characteristics of mothers of well-nourished and undernourished children under-five

Characteristics	Total children (n=133)		Well-nourished children (n=39)		Undernourished children (n=94)	
	Count	Column %	Count	Column %	Count	Column %
Age (years)						
≤30	99	74.4%	27	69.2%	72	76.6%
>30	34	25.6%	12	30.8%	22	23.4%
Education						
Literate	77	57.9%	22	56.4%	55	58.5%
Illiterate	56	42.1%	17	43.6%	39	41.5%
Occupation						
Employed	16	12%	06	15.4%	10	10.6%
Unemployed	117	88%	33	84.6%	84	89.4%
Residence						
Urban	127	95.5%	39	100%	88	93.6%
Rural	6	4.5%	0	0.0%	06	6.4%
Family income (PKR/month)						
>25000	59	44.4%	28	71.8%	31	33%
≤25000	74	55.6%	11	28.2%	63	67%
Number of family members						
2-3	92	69.2%	29	74.3%	63	67%
4-5	31	23.3%	09	23.1%	22	23.4%
6-7	10	7.5%	01	2.6%	09	9.6%
Knowledge of contraception method						
Yes	88	66.2%	25	64.1%	63	67%
No	45	33.8%	14	35.9%	31	33%
Practicing contraception method						
Yes	34	25.6%	11	28.2%	23	24.5%
No	99	74.4%	28	71.8%	71	75.5%
BMI (Kg/m^2)						
Normal	49	36.8%	20	51.3%	29	30.9%
Underweight	14	10.5%	0	0.0%	14	14.9%
Overweight	48	36.1%	13	33.3%	35	37.2%
Obese	22	16.5%	06	15.4%	16	17%
Malnutrition						
No	49	36.8%	20	51.3%	29	30.9%
Yes	84	63.2%	19	48.7%	65	69.1%

The ethical approval was taken from Ethics Review Committee, Fatima Jinnah Medical University Lahore Pakistan (No. 87/Research Proposal/Preventive Pediatrics/FJ/ERC dated 25th September 2023. Informed consent was sought from all participants.

RESULTS

The mean age of 133 index children was 17.9±12.7 (range 6-59 months). Other characteristics of well-nourished and undernourished children under-five are given in Table 1.

Mean age of 133 mothers was 28.1±4.4 (range 20-40 years). Other characteristics of mothers of well-nourished and undernourished children under-five are given in Table 2.

Among undernourished children (n=94), 80 (85.1%) had demonstrated all three indicators of undernutrition. The frequencies of individual and coexisted indicators of undernutrition are given in Table 3. Both crosstabs as well as binary logistic regression analysis showed that birth interval and contraception knowledge & practices were not related to childhood undernutrition (all p-values >0.05). However, age and birth order of index child, family income and mother's BMI showed significant association with childhood undernutrition (all p-values ≤0.05), as reflected in Table 4.

Table 3: Individual and coexisted indicators of undernutrition among children under-five

Characteristics	Undernourished children (n=94)	
	Count	Column %
Underweight		
No	01	1.1%
Yes	93	98.9%
Stunted		
No	07	7.4%
Yes	87	92.6%
Wasted		
No	06	6.4%
Yes	88	93.6%
Coexisted undernutrition		
Wasting and stunting	01	1.1%
Wasting and underweight	07	7.4%
Stunting and underweight	06	6.4%
All three indicators	80	85.1%

Table 4: Binary logistics regression analysis

Characteristics	Odds ratio	95% CI lower	95% CI upper	p-value	Adjusted odds ratio	95% CI lower	95% CI upper	p-value
Age (>24/≤24 m)	5.843	2.341	14.588	<0.001	3.730	1.174	11.856	0.026
Gender (Male/Female)	1.053	0.499	2.221	0.893	1.432	0.539	3.805	0.471
Number of siblings (≤3/>3	1.427	0.618	3.297	0.404	0.554	0.066	4.656	0.586
Birth order (other/3rd)	1.230	0.529	2.861	0.630	1.920	0.598	6.163	0.273
Birth order (other/4th)	1.404	0.428	4.610	0.574	2.518	0.197	32.225	0.478
Birth order (other/5th)	9.000	1.157	69.979	0.013	27.228	1.327	558.750	0.032
Birth interval (other/<12 m)	1.721	0.349	8.496	0.501	1.211	0.143	10.249	0.860
Birth interval (other/12-23 m)	0.815	0.379	1.749	0.599	1.168	0.311	4.389	0.818
Birth interval (other/24-33 m)	0.837	0.382	1.835	0.657	1.123	0.301	4.194	0.863
Mother's age (≤30/>30 y)	0.688	0.300	1.578	0.375	0.766	0.242	2.421	0.650
Family income (>25000/≤25000 PKR)	5.173	2.280	11.738	<0.001	5.018	1.866	13.494	0.001
Mother's education (literate/illiterate)	0.918	0.432	1.951	0.823	0.507	0.186	1.381	0.184
Mother's occupation (working/not working)	1.527	0.514	4.539	0.444	1.444	0.349	5.965	0.612
Knowledge of contraception method (yes/no)	0.879	0.402	1.922	0.746	0.810	0.276	2.374	0.701
Practicing contraception method (yes/no)	1.213	0.523	2.812	0.653	1.898	0.539	6.679	0.318
BMI (18.5-24.9/<18.5 & >24.9)	2.359	1.097	5.072	0.026	3.019	1.099	8.298	0.032
Constant					0.072			0.028

DISCUSSION

Birth interval is a period between two consecutive live births. The WHO recommends that it should be between 36 and 60 months.[5] Short and long birth intervals can adversely affect pregnancy outcomes.[12] Family planning can help women achieve optimum birth intervals, which allows them to recover and be healthy for their next pregnancy. According to the UNFPA, the current total fertility rate in Pakistan is 3.3 per woman and the prevalence of contraceptives (any method) in married women aged 15-49 years is 39%.[13] Due to the high fertility rate and low contraceptive use, the birth interval can be short, which may influence neonatal and childhood outcomes.

In a meta-analysis of forty-six studies, it had been concluded that birth interval ≥24 months were significantly associated with less likelihood of childhood undernutrition and an optimal birth interval (36-48 months) appeared to decrease the frequency of poor nutritional outcomes in children, particularly underweight.[14] In a different way, Kamal and colleagues reported that children born to mothers having birth intervals <24 months were at significantly higher risk of being stunted and underweight among children under-five in Bangladesh (p-value <0.001).[15] Kannaujiya and colleagues also reported that interpregnancy interval (<12 months) was linked with higher risk of stunting (OR=1.13; 95% CI, 1.08–1.18) and underweight (OR=1.06; 95% CI, 1.01–1.11) among children under-five in India.[16] Kahssay and coworkers also reported that short preceding birth interval (<24 months) was determinant of stunting among children under-five in Ethiopia (aOR=4.94; 95% CI, 2.17–11.2).[17] These findings are not in agreement with the results obtained in our study, where no relationship was found between birth interval, contraception knowledge & practices and childhood undernutrition. The present study revealed that nearly one-third of mothers of index children had no knowledge about contraception methods and more than two-thirds of mothers were not practicing any contraception method. Although the mothers not practicing contraception methods showed twice a higher risk for childhood undernutrition, but the relationship was not statistically significant. This might be due to the limitations of the study that are single-centre study, small sample size, and convenience recruitment of participants. However, Eliafiana and coresearchers also reported that short interval of birth spacing is not a direct cause of stunting as there are other related modifiable factors in children 24-59 months in Indonesia.[18]

Males are more likely to be undernourished during early childhood in low resource settings.[19] Sultana et al. reported that the likelihood of being stunted increased with age, with the highest rate in children aged 36 to 47 months, which was considerably larger than children aged <6 months (OR=6.7; 95% CI, 4.4–10.1). Female children had 11% less likelihood of being stunted than male children under-five in Bangladesh (OR=0.89; 95% CI, 0.78–1.02).[20] In the present study, sex differences for undernutrition were not observed; however, the age of child ≤24 months and family income ≤25000 PKR demonstrated significantly higher risk for undernutrition than their counterparts.

Kiik and colleagues reported that maternal height, education and antenatal care (ANC) clinic visit had a significant relationship with stunting (all p-values <0.05);

but maternal age showed no significant association with stunting (p-value 0.611).[10] Likewise, Kahssay and coworkers reported that maternal height <150 cm (aOR=3.7; 95% CI, 1.5–9.2), no education (aOR=4.9; 95% CI 1.9–12.4), and no ANC follow-up (aOR=2.8; 95% CI, 1.5–5.4) were determinants of stunting.[17] Khan and group reported that mothers having no education were more likely to have wasted children (aOR=3.6; 95% CI, 1.3–9.8); and maternal BMI was significantly associated with underweight children.[21] Sultana and associates reported that mothers having normal BMI were less likely to have children with stunting (OR=0.8; 95% CI, 0.7–0.9).[20] In the same way, the present study found that mother's BMI was significantly related with higher risk of undernutrition. A higher birth order has been reported to significantly increase the risk for undernutrition.[22] Birth order was one of the significant predictors of child being stunted. After adjustment, the children with birth order 3 (24%), birth order 4 (30%), and birth order ≥5 (72%) were more likely to be stunted.[23] Similarly, higher birth order (≥5) demonstrated greater risk (aOR=27.0; 95% CI, 1.32–558.75) and a significant relationship with childhood undernutrition (p-value 0.032) in the present study.

Short birth intervals showed insignificantly higher odds for childhood undernutrition. However, index child's age, birth order, family income, and maternal BMI demonstrated greater risk and a significant relationship with undernutrition among children under five. Limiting the number of births and improving maternal health and nutrition may reduce child malnutrition.

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