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ORIGINAL ARTICLE

Comparison of Mean Weight, Length and Head Circumference in Preterm Neonates with Zinc Supplement Group Versus without Zinc Supplement Group

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ABSTRACT

Objective: To compare mean weight, length and head circumference in preterm neonates with zinc supplement group versus without zinc supplement group.

Design of the Study: Randomized controlled trial

Study Settings: The study was carried out in the Pediatric Department of Lahore General Hospital Lahore from February 2021 to July 2021.

Material and Methods: There were two groups of babies: one that received Zinc supplementation and one that did not (not treated with Zinc supplements). An electronic weighing scale was used to measure weight prior to intervention. Mothers were given two bottles of supplement containing zinc when their newborns were 7 to 21 days old, before being discharged from the hospital, and encouraged to feed their babies orally at a dose of 2 mg/kg/day with other multivitamins for six weeks (study group). For the same period of time, the participants in the control group were advised to take only multivitamins. Additionally, anthropometric measurements such as weight, height, and head circumference were taken.

Results of the Study: In our study, mean age was calculated as 33.74+1.36 weeks in study and 33.64+1.38 weeks in control group, 54.76%(n=23) in study and 59.52%(n=25) in control group were male while 45.24%(n=19) in study and 40.48%(n=17) in control group were females

Conclusion: Preterm neonates supplemented with zinc were significantly better than those without zinc supplementation with regards to mean weight, length and head circumference

Keywords: Preterm neonates, zinc supplementation, birthweight, body length, head circumference

INTRODUCTION

Premature babies are at greater risk of death, sickness, both acute and long-term, all of which can be traced back to malnutrition and stunted development. Preterm births account for around 13 million annual births worldwide, with the majority (85%) of these occurring in Africa and Asia (31 percent and 54 percent, respectively).[1,2,3] Preterm and low birth weight babies seems to be at threat for zinc deficiency because they have low body stores, a restricted capacity to absorb and maintain micronutrients, and more endogenous losses due to organ immaturity. They also have a higher nutrient requirements to sustain catch-up development and insufficient intakes because only breastfeeding doesn't cover the extra demand due to prematurity.[4] Premature babies have a zinc shortage and dietary needs due to the fact that 60% of a foetus' zinc is acquired in the third trimester of pregnancy..[5] The endocrine system is adversely affected by zinc deficiency, and this results in a variety of symptoms, including growth failure.[6]

Hormones, nucleotides, and proteins all include zinc. An extensive range of enzymes necessary to the body's metabolic processes rely on it (i.e. nucleic acid metabolism, organogenesis, immune function and synthesis of protein).[7] When it comes to a baby's development in the womb and after birth, zinc is essential. Additionally, zinc absorption and retention are less efficient in premature newborns. Excessive endogenous losses result from inadequately controlled secretion or interference with reabsorption when intake is restricted or the digestive and absorptive systems are immature. As a result, preterm newborns have particularly high needs for zinc in their diets.[8,9]

When it comes to newborns' zinc requirements and ideal daily intakes, research on zinc homeostasis has yielded some mixed results. Innumerable studies have shown that zinc, in various dosages, promotes healthy growth in youngsters.[10,11] Zinc in human milk, like phosphorus and calcium, might not have been ideal for extremely preterm newborns and feedings of human-milk should be supplemented with extra zinc for this population, according to evidence.[12,13]

Marthur et al. (2015)[14] at Maulana Azad Medical College, New Delhi, India, studied the effects of zinc supplementation on the growth of premature newborns. They observed that (those receiving oral zinc supplementation) had significantly greater mean serum alkaline phosphatase levels than the controls at 3 months corrected age. Zinc supplementation was found to improve development and growth in preterm neonates throughout the first six months of life in another study by Ragab et al[15]. After six months, the zinc-supplemented group showed a considerable rise in weight (7015.8 ± 432.6) and length (64.8± 1.3) compared to the non-zinc-suppleeded group, which weighed 6665.3 ± 438.2 and measured 61.6± 1.4 (head circumference 42.7± 0.9 vs. 42.6± 7.09).

The zinc-supplemented group showed a substantial increase (P< 0.05) in both weight 6730 ±279.35 and length 61.4 ±1.02 at the age of six months in comparison to the non-zinc-supplemented group weight 6566.7 ±292.83 and length 60.5± 1.83, at day 1 and at six months in the zinc-supplemented group.[16]

There is no local study available reporting the effectiveness of zinc supplementation on growth and development in preterm babies. Pakistan is one of those South Asian countries where rise in premature births has been dramatic. In addition, low molecular weight and deficiency of micronutrients including zinc has resulted in growth retardation of those preterm babies. So this study will test the effect of oral zinc supplements on the growth and development of preterm babies

MATERIAL AND METHODS

After receiving approval from the hospital's ethical committee the study was carried out. Patients. Randomized controlled trial study was carried out at Pediatric Department of Lahore General Hospital Lahore from February 2021 to July 2021. The sample size of 84 (42 patients in each group) is calculated with a significance level of 95% and a power of 80 per cent by using mean length 61.4±1.02at 6 month for zinc supplemented and mean length 60.5±1.81 for non-zinc-supplemented.[8] Infants with

gestation age between 32-36 weeks, birth weight between 1800 and 2500 g and infants in a stable clinical condition without any evidence of disease likely to influence growth and neurodevelopment were included in this study.

Patients admitted in the hospital fulfilling the inclusion criteria were enrolled in the study. Before the patient was enrolled in the trial, the patient's parents signed an informed consent form. After registering the patient, the mother or family of the patient provided a complete history and a physical examination was conducted. The mother's medical records were used to calculate gestational age. The included babies were allocated randomly in to two groups by lottery method i.e. study group (Zinc supplementation) and the control group (not treated with Zinc supplements).

An electronic weighing scale was used to measure weight prior to intervention. Mothers were given two bottles of supplement containing zinc when their newborns were 7 to 21 days old, before being discharged from the hospital, and encouraged to feed their babies orally at a dose of 2 mg/kg/day with some other multivitamins for 6 weeks (study group). For the same period of time, the participants in the control group were advised to take only multivitamins. Patients were instructed to return to the follow-up clinic six weeks later.

Diarrhea, respiratory sickness, fever or vomiting and feeding patterns were documented over these six weeks. Additionally, anthropometric measurements such as weight, height, and head circumference were taken. An digital weight scale with a precision of 5 g was used to record the subject's bare weight. In the supine posture, the length was measured to the nearest 1 mm from the crown to the heel.

All the findings were recorded in a standardized proforma and data was analyzed using SPSS software (Version 23). Quantitative variables such as age, weight, length and head circumference was described by means and standard deviations, and qualitative variables (such as gender) by frequency percentage. Independent samples t-test was applied to observe the significance differences between two groups taking P-value < 0.05 as significant.

STUDY RESULTS

Gestational age of preterm neonates was calculated as 71.43%(n=30) in study group and 73.81%(n=31) in control group in 32-34 weeks of gestation whereas 28.57%(n=12) in study and 26.19%(n=11) in control group were between 35-36 weeks of gestation, mean±sd was calculated as 33.74±1.36 weeks in study and 33.64±1.38 weeks in control group. Gender distribution shows that 54.76%(n=23) in study and 59.52%(n=25) in control group were male while 45.24%(n=19) in study and 40.48%(n=17) in control group were females as shown in Table No. 1.

Table 1: Gestational Age and Gender Distribution of the Patients

Age(weeks)	Sub-division	Study group(n=42)		Control group(n=42)	
		No. of patients	%	No. of patients	%
Gestational Age	32-34	30	71.43	31	73.81
	35-36	12	28.57	11	26.19
Gender	Male	23	54.76	25	59.52
	Female	19	45.24	17	40.48

Table 2: Baseline Measurements

Variables	Study group(n=42)	Control group(n=42)
Gestational Age	33.74±1.36	33.64±1.38
Birth weight	2385±.95	2377.62 ±42.87
Body length	43.10±1.41	43.08±1.46
Head circumference	32.21±0.92	32.71±0.77

Baseline birth weight was calculated as 2385.95±50.22 grams in study and 2377.62±42.87 grams in control group, p value was 0.42, body length was 43.10±1.41 cm in study and 43.08±1.46 in control group, p value was 1.00, head circumference in study group was 32.21±0.92cm and 32.71±0.77cm in study group, p value was 0.008 as shown in table no.2.

Comparison of weight, length and head circumference in preterm neonates with zinc supplement group versus without zinc supplement group is given in Table no. 3.

Table No 3: Comparison of mean weight, mean length & mean head circumference in preterm neonates with zinc supplement group versus without zinc supplement group

Parameters	Study group		Control group		P-value
	Mean Weight				
	Mean	SD	Mean	SD	P-Value
Baseline	2385.95	50.22	2377.62	42.87	0.0001
After treatment	4997.38	213.51	4257.52	100.69	
Increase	2611.43	217.39	1879.91	90.41	
Mean Length					
	Mean	SD	Mean	SD	P-Value
Baseline	43.10	1.41	43.08	1.46	0.0001
After treatment	50.62	2.28	49.62	1.94	
Increase	7.52	2.58	6.52	1.58	
Mean Head Circumference					
Parameters	Mean	SD	Mean	SD	P-Value
Baseline	32.21	0.92	32.71	0.77	0.02
After treatment	37.33	1.12	36.60	1.85	
Increase	5.12	1.50	3.88	1.45	

DISCUSSION

In human preterm birth (PTB) is defined as a baby born before 37 weeks or 259 days of gestation, in Pakistan, prevalence of Preterm Birth was found to be 18.89%.[17]

In our study, mean age was calculated as 33.74+1.36 weeks in study and 33.64+1.38 weeks in control group, 54.76%(n=23) in study and 59.52%(n=25) in control group were male while 45.24%(n=19) in study and 40.48%(n=17) in control group were females. Comparison of weight in preterm neonates with zinc supplement group versus without zinc supplement group shows mean increase in birth weight was 2611.43+217.39 grams in study and 1879.91+90.41 grams in control group, p value was 0.0001, 7.52+2.58 cm in study and 49.62+1.94cm increase in body length in control group, p value was 0.033, 5.12+1.50 cm in study and 3.88+1.45cm increase in head circumference in control group, p value was 0.02.

Marthur and Kagarwal[6] discovered that the study group (treated with oral zinc supplementation) had significantly higher mean serum alkaline phosphatase levels than controls at 3 months corrected age.[6] In another study, Ragab et al.[7] concluded that zinc supplementation in preterm infants enhances their linear growth and confers some protection against the expected decrease in haemoglobin.[7]

In another study by El Mashad et al. group of zinc supplementation showed a statistically significant increase (P<0.05) in both weight 6730± 279.35 and length 61.4± 1.02 at the age of 6 months in the supplementation of zinc group compared with without zinc supplemented group weight 6566.7± 292.83 and length 60.5± 1.81, at day 1 and at 6 months.[8] However, our followup period was 6 weeks only.

Even for extremely low birth weight newborns, zinc supplementation via parenteral nutrition should be sufficient to meet zinc requirements. Enterally administered zinc in acceptable dosages should also be considered (ELBW). Zinc needs can be determined using a variety of methods. It's interesting to note that over the previous decade, the recommended dietary allowances have steadily climbed. Between 0.8 and 3 mg/kg/day is the recommended daily consumption. In order to maintain adequate zinc retention in preterm neonates, up to 3 mg/kg/day of zinc may be required for term newborns. The recommendations of scientific

organisations and committees on intravenous supplements are more consistent.

Different authors recommend 350 mcg/kg per day of parenteral zinc supplementation despite the fact that only 60% of the zinc is absorbed. Using larger zinc dosages in VLBW infants has been shown to improve survival and minimise morbidity. Higher levels of zinc supplementation are also justified by the fact that the baby receives up to 1 mg/Kg/day of zinc from the mother during the final trimester of pregnancy."

Because of this, in order to get the same amount of food into the body, 0.5–0.8 mg/Kg/day or 4–5 mg/day zinc should be provided by the parenteral or oral route, respectively, to achieve a similar zinc intake. We used 2mg/Kg/day in our study, on the other hand. Before making any changes to present zinc guidelines, further investigations, particularly pharmacokinetic studies, are recommended.

In Pakistan, no published data was available addressing zinc supplementation for the management of preterm neonates. The results of our study in accordance to other above mentioned studies justify the hypothesis that “babies treated with zinc supplementation show better growth as compared to babies with zinc supplements”. However, further multicenter local studies are required to validate our results.

CONCLUSION

Preterm neonates supplemented with zinc were significantly better than those without zinc supplementation with regards to mean weight, length and head circumference

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