

## The effect of Zinc on the growth of preterm baby in Baghdad, Iraq

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### Abstract

**Background:** Zinc is an essential trace nutrient, has important function to play in growth. Many studies have indicated that a negative Zinc balance exist in preterm and small for gestational age infants until approximately 37 weeks of gestation. Several workers have recorded an improved Zinc status, good weightgain and better linear growth velocities in preterm infants supplement with Zinc. Aim of study: The current study evaluates the effect of zinc supplementation on growth parameters of premature infants. Also to determine the role of zinc therapy in treatment of acute diarrhea in children aged 3 months - 2 years. **Methods:** This randomized clinical trial study was done in Imamein Kadhemain Medical City, pediatric department, in the period from 1st December 2013 to 30th July 2014. One hundred hospital born preterm infant with gestational age <37 weeks, whose were admitted to the hospital, when they were ready for discharge, they randomly assigned to receive Zinc & multivitamins (50 neonates) or multivitamins only (50 neonates). Multivitamin are vitamin A, vitamin D, iron & folic acid. The Zinc group received it in a dose of 2 mg/kg/day. Weight, length and head circumference were followed up after 4 weeks. **Results:** In this study no significant difference in weight, length and head circumference between the zinc group & control group at the start but a significant difference were found at 4 weeks follow up (P<0.05). **Conclusion:** Zinc supplementation for preterm babies was found effective to enhance the growth in early weeks of life, while in regard to difference in growth according to types of feeding there is no significant difference.

**Key words:** Zinc, Preterm, Weight, Length, Head circumference, Multivitamins

### Introduction

Live born infants delivered before 37 weeks from the 1st day of the last menstrual period are termed premature by the World Health Organization [1]. Preterm is a major problem in the developing world, and is accompanied by high perinatal morbidity and mortality rate. Out of 22 million preterm babies, 21 million are born every year in developing countries; of these 16 million are small for gestational age babies [2]. Zinc is involved in numerous aspects of cellular metabolism [3]. It was estimated that about 10% of human proteins potentially bind zinc, in addition to hundreds which transport and traffic zinc. It was required for the catalytic activity of more than 200 enzymes and it play a role in immune function, wound

healing, protein synthesis, DNA synthesis and cell division [4, 5]. Zinc is required for proper sense of taste and smell and it supports normal growth and development during fetal life, infancy, childhood, and adolescence [6, 7]. It was believed to possess antioxidant properties, which may protect against accelerated aging and help speed up the healing process after an injury [8]. Zinc ions are effective antimicrobial agents even at low concentrations. Gastroenteritis was strongly attenuated by ingestion of zinc and this effect could be due to direct antimicrobial action of the zinc ions into the gastrointestinal tract, or to the absorption of the zinc and re-release from immune cells [9]. Zinc was played an essential rule in neurodevelopment as zinc-dependent enzymes are involved in brain growth, zinc-containing proteins participate in brain structure and neurotransmission, and finally zinc is involved in

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the production of neurotransmitters which are involved in brain memory function [10]. About 60% of fetal zinc was acquired during the third trimester of pregnancy, the fetal weight increase three-fold. Preterm infants (<37 weeks gestation) have lower zinc reserve than term infants and because of immaturity, they may be less efficient in absorbing and retaining zinc for growth [11]. Low zinc concentrations have been observed in the cord blood of low birth weight newborn babies (<2500 g) and birth weight has been shown to be highly correlated with cord zinc concentration [12]. The zinc be the one of the most common hidden health problems in children, since, unlike iron deficiency, zinc was not something for which pediatricians routinely screening. The recommended intake of zinc in children aged 1 – 6 years is 7 mg/day [13, 14]. For several reasons, preterm infants have relatively high zinc dietary requirements and face special challenges to meet them. Zinc deficiency has a negative effect on the endocrine system, leading to growth failure among other clinical manifestations [15].

**Materials and Methods**

The clinical trial study was done in Imamein Kadhmain Medical City, pediatric department, in the period between 1st December 2013 to 31<sup>st</sup>July 2014. One hundred hospital born preterm infant with

gestational age <37 weeks & weight between 1.480 to 2.550 kg which is appropriate for gestational age, who were admitted to the hospital for different clinical problems, after treatment & stabilized when they were ready for discharge ,they were randomly assigned to receive Zinc & multivitamins (50 neonates) or multivitamins only (50 neonates). The Zinc group received it in a dose of 2 mg/kg/day daily for 4 weeks. The Zinc preparation is Zinc Sulphate 10 mg tablets, we divided the tablet according to calculated dose & advice the mother to solve it & gives it with milk in artificially fed babies and with water in breast fed ones. Weight, length and head circumference are measured & followed up after 4 weeks & 10 weeks. Ten patients only came for the second follow up, so we restrict this study to 4 weeks follow up only. We divided our newborn into 3 groups according to gestational age (30-32), (34-35) & (35-36) weeks according to modified billard score. The weight is measure using electric weight scale. The length & head circumference is measure using plastic tape measure.

**Data construction & measure:** Data entry and analysis were done using SSPS program, version 11. A p. value less than 0.05 consider significant. Standard deviation was measured by used Excel program and Chi sequare test was applied

**Results**

In table 1, the average increment in weight after 4 weeks in zinc group neonates with (30-32) weeks gestational age is 0.479 kg , in control group neonates is 0.322 kg. In those (33-34) weeks gestational age in zinc group neonate is 0.489 kg & in control group neonates is 0.347 kg. In those with (35-36) weeks gestational age in zinc group neonates is 0.512 kg while in control group neonate is 0.360 kg. There is significant difference in weight gain between the two groups, p value is statistically significant (<0.05).

**Table-I :Difference in weight gain between zinc & control groups.**

Gestation al age (week)	Zinc			Control			p- value
	Percent % (number)	Average length at start (cm) ±SD	Average increment after 4 weeks (cm) ±SD	Percent % (number)	Average length at start (cm) ±SD	Average increment after 4 weeks (cm) ±SD	
30-32	38% (19)	41.97±1.0065	4.20 ±0.00501	40% (20)	41.90±1.0065	3.10 ±0.0223	<0.001
33-34	32% (16)	44.50±0.5163	4.25±0.0050	30% (15)	44.53±0.5163	3.11 ±0.0053	<0.001
35-36	30% (15)	46.4±0.5070	4.27±0.0050	30% (15)	46.4±0.5070	3.18±0.0037	<0.001
<b>Total</b>	<b>100% (50)</b>			<b>100% (50)</b>			

In table 2, the average increment in length after 4 weeks in zinc group neonates with (30-32) weeks gestational age are 4.20 cm, in control group neonates is 3.10 cm. In those (33-34) weeks gestational age in zinc group neonates is 4.25 cm

& in control group neonates is 3.11 cm. In those with (35-36) weeks gestational age in zinc group neonates is 4.27 cm while in control group neonates is 3.18 cm. There is significant difference in length gain between the two group, p value is statistically significant (<0.05).

**Table- II: Difference in length gain between zinc & control groups**

Gestational age (week)	Zinc			Control			p-value
	Percent % (number)	Average weight at start (kg) ±SD	Average increment after 4 week (kg) ±SD	Percent % (number)	Average weight at start (kg) ±SD	Average increment after 4 week (kg) ±SD	
30-32	38% (19)	1.685±0.143	0.479±0.0809	40% (20)	1.675±0.143	0.322 ±0.0489	<0.001
33-34	32% (16)	2.175±0.1290	0.489 ±0.0080	30% (15)	2.183±0.1290	0.347 ±0.0088	<0.001
35-36	30% (15)	2.472±0.1267	0.512 ±0.0809	30% (15)	2.482±0.1267	0.360 ±0.0088	<0.001
<b>Total</b>	<b>100% (50)</b>			<b>100% (50)</b>			

**Table -III: Difference in head circumference gain between zinc & control groups**

Gestational age (week)	Zinc			Control			p.value
	Percent % (number)	Average head circumference at start (cm) ±SD	Average increment after 4 weeks (cm) ±SD	Percent % (number)	Average head circumference at start (cm) ±SD	Average increment after 4 weeks (cm) ±SD	
30-32	38% (19)	29.10 ±0.8093	2.35±0.0066	40% (20)	29.05±0.8093	2.01±0.0119	<0.001
33-34	32% (16)	31.05±0.4647	2.40±0.0066	30% (15)	31.08±0.4647	2.10±0.0119	<0.001
35-36	30% (15)	32.4±0.5070	2.44±0.0066	30% (15)	32.4±0.5070	2.18±0.0119	<0.001
<b>Total</b>	<b>100% (50)</b>			<b>100% (50)</b>			

In table 3, the average increment in head circumference after 4 weeks in zinc group neonates with (30-32) weeks gestational age are 2.35 cms , in control group neonates is 2.01 cm. In those (33-34) weeks gestational age in zinc group neonates is 2.40 cm & in control group neonates is 2.10 cm. In those with (35-36) weeks gestational age in zinc group neonates is 2.44 cm while in control group neonates is 2.18 cm. There is significant difference in head circumference gain between the two groups, p value is statistically significant (<0.05).

## Discussion

This study shows that zinc supplementation to preterm babies for 4 weeks resulted in improved weight gain and linear growth and head circumference. There were no significant side effects of the supplements. These findings could have important implications for child health survival program especially in developing countries with high incidence of preterm low birth infants.

The strengths of that study included its randomized, double-blind design and minor differences in initial anthropometric status of the studied groups, thus any differences in study outcomes were likely due to the supplements of zinc that were provided.

Limitations of the study included: single center study, supplementation was given for shorter duration, surveillance was not conducted daily and long term follow-up was not done due to difficulty in communication, and fund limitation. There were no significant difference in weight, length and OFC between the control & zinc groups at the start of the study but a significant difference were found at 4 weeks follow up (P<0.05). This was understandable as zinc has profound role on cellular growth and proliferation and performs various metabolic functions. Similar studies were obtained about the effect of zinc supplement on growth among premature infant from developing countries ,as is from India (two studies), [16, 17], Bangladesh (one study), [18], Chile (one

study), [19] and Brazil (one study), [20]. The duration of supplementation in these studies ranged from 4 weeks to 1 year and the dosage of zinc supplement varied between 2 mg to 5 mg per day in first 6 months of age and 10 mg of zinc per day for 6-12 months. Both short term (4-6 weeks) studies (Hoque S, Lira PI), [18, 20] and long term (6 months-1 year) studies (Sur D, Castillo-duran C.), [17, 19], zinc supplementation had a beneficial effect on weight gain, length. Freil et al, [14], reported significant increase in linear growth but not in weight gain. MN Islam show increment in weight, length & head circumference in 6 weeks supplementation [21]. On the contrary, the largest randomized clinical trial conducted on preterm Indian infants concluded no beneficial effect on length and weight gain with zinc supplementation give for a period of one year, although a positive effect on plasma zinc concentration was observed [16].

A recent meta-analysis on effect of micronutrients on physical growth in children <5 years did not report improvement in linear growth with zinc supplement [22]. One study (Diaz Gomez) among preterm infants showed positive effect on plasma zinc concentrations and linear growth, [23] and one study (Bueno-O) on preterm infants showed no effect [24]. However, no significant effect on weight gain was observed in any of these studies. Some of the conflicting data regarding impact of zinc on growth in preterm infants may be contributed by mixing low birth weight and preterm births. Most of the studies that had evaluated impact in low birth weight infants in developing countries have not reported gestational age due to difficulty of ascertaining it and so would had recruited a variable mixture of preterm births and small for gestational age babies.

## Conclusions

Zinc supplementation for preterm low birth weight babies was found to be effective to enhance the growth in early weeks of life.

## Recommendations:

1. Zinc supplementation can be recommended along with other vitamins and minerals to preterm infants for their growth.
2. We recommend larger sample & longer duration of supplement & follow up to clarify the effect of zinc supplement on growth of preterm.
3. Measurement of serum zinc level at the start & after zinc supplement to correlate it to growth parameters will be of significance.

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