Fetal Abdomen Circumference Percentile Changes with Zinc Therapy on Pregnant women

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Abstract

Aim: To assess the percentile change in fetal abdominal circumference by giving zinc to pregnant women

Methods: This is an observational analytical study with a prospective design. The sample was pregnant women who did antenatal care examinations at the University of North Sumatra Hospital and other private hospitals in the city of Medan during the 2020 study period who met the inclusion and exclusion criteria. Sampling using consecutive sampling technique with 31 sample size. Statistical data were analyzed using independent sample t-test data and correlation and linear regression tests with a significance level of p=0.05.

Results: The mean fetal abdominal circumference before treatment in zinc group was 153.15 mm (SD = 26.74 mm) while in the control group was 148.85 mm (SD = 40.06 mm). There was no significant difference in mean fetal abdominal circumference between the treatment and control groups (p = 0.692). The size of the fetal abdominal circumference after zinc administration increased to 282.15 mm (SD = 24.63 mm), there was a significant difference in the size of the fetal abdominal circumference before and after the administration of zinc tablets (p<0.001). The increase in fetal abdominal circumference in the zinc-treated group was 129 mm (SD = 8.29 mm) while in the control group it was 117.55 mm (SD = 9.89 mm).

Conclusion: There is a significant difference in the size of the fetal abdominal circumference between the group of mothers who were given zinc tablets and the control group.

Keywords: Abdominal Circumference, Fetus, Zinc, Pregnant

I. INTRODUCTION

Child growth is influenced by two factors, direct factors and indirect factors. Direct factors that affect children's growth include nutritional intake, infectious diseases, and genetics. Meanwhile, indirect factors include access to health services, socio-economics, mother's knowledge and education, as well as food supplies at home.[1]

One of the impacts if a child is malnourished is a decrease in the speed of growth or a linear growth disorder so that the child fails to reach the potential height which results in the child being stunted. The prevalence of stunted children under five years old nationally in 2010 was 35.6%. The prevalence of toddlers and toddlers aged 24-35 months in the very short category in Central Java is 16.9% and 22.8%, while those in the short category are 17.0% and 18.6%, respectively. The prevalence of very short toddlers aged 24-35 has increased compared to the results of Riskesdas in 2007 which was 21.5% to 22.8%. In Surakarta, the prevalence of very short and short toddlers is 12.3% and 10.3%.[2]

Zinc is a nutrient that plays an important role in many body functions such as cell growth, cell division, body metabolism, immune function and development. Zinc supplementation significantly had a positive response to weight and height gain, and was able to increase linear growth in stunted adolescents and children.[3]

Small-scale studies conducted in Central Java, West Java, Lombok, and NTB between 1997-1999 found zinc deficiency in infants ranging from 6%-39%. Research on infants in Bogor, West Java, found that the prevalence of zinc deficiency reached 17% and in Indramayu 47.9%. Meanwhile, studies in Central Java and NTT on 500 school-age children with zinc deficiency were 26.8% and 24.2%, respectively.10 the survey in 9 provinces found that the prevalence of zinc deficiency among children under five years old was on average 31.9% with a range of 11.7% in West Sumatra to 46.6% in NTB.[4]

The condition of pregnancy is a determinant of the success of the growth of the fetus and baby. Pregnancy is the most critical, sensitive and unique period in a woman's life. Since the fetus is in the womb, the formation of quality resources should be started. The condition of stunting at birth is associated with a higher risk of stunting in childhood and adulthood. The sooner a child is detected as short after birth, then it tends to become very short and experience various negative consequences if not treated immediately.[5]

Several ultrasound parameters can assess fetal growth and development in the womb, one of which is fetal abdominal circumference, a measurement of fetal abdominal circumference that can detect intrauterine fetal weight early. The nutritional status of the mother during pregnancy is known to have an effect on intrauterine fetal growth and development which can be seen from changes in fetal abdominal circumference at each gestational age.[6]

II. METHODS

This research is an observational analytic study with a prospective design conducted at the University Hospital of North Sumatra and several private hospitals in the city of Medan. The study was conducted from July - December 2020 with the target population being pregnant women in the second and third trimesters. Sampling used consecutive sampling technique and samples were taken according to the inclusion and exclusion criteria. Inclusion criteria were pregnant women age 20-35 years, 2nd and 3rd trimester's gestational age, and height of pregnant women ≥150 cm. Exclusion criteria were nutritional status of malnourished pregnant women, twins, and babies with congenital abnormalities. Research subjects were given zinc tablets 20 mg/day for 12 weeks. After 12 weeks, the fetal abdominal circumference was measured by ultrasound examination. The results will be collected, tabulated, and analyzed. P value <0.05 at 95% confidence interval was considered significant.

III. RESULTS

From 62 pregnant women, the mean age of the subjects in the treatment group was 28.58 years and in the control group was 28.28 years (Table 1). The mean gestational age in the treatment group was 20.94 weeks with the youngest gestational age being 22 weeks and the oldest being 27 weeks. The average weight and height were 60.81 kg and 157.23 cm in the treatment group and 59.71 kg and 155.32 cm, respectively, in the control group. The mid upper arm circumference (MUAC) in the treatment group was 25.48 cm with the smallest MUAC 22 cm and the largest 31 cm. There were no significant differences in mean age (p = 0.922), mean gestational age (p = 0.865), mean weight and height (p>0.05), and mean MUAC (p = 0.367) between treatment and control group.

Table 1. Sample Characteristics

Characteristics	Treatment (n = 31)	Control (n = 31)	p
Age, years			
Mean (SD)	28,58 (3,58)	28,48 (4,14)	0,922[a]
Median, (Min – Max)	28 (22 – 35)	28 (20 – 35)	
Gestational age, weeks			
Mean (SD)	20,94 (3,33)	21,13 (3,71)	0,865[b]
Median, (Min – Max)	21 (15 – 27)	21 (16 – 27)	
Body Weight, mean (SD), kg			
Mean (SD)	60,81 (7,7)	59,71 (6,93)	0,592[b]
Median, (Min – Max)	59 (50,5 – 86)	59 (50 – 77,5)	
Height, Mean (SD), cm			
Mean (SD)	157,23 (5,54)	155,32 (4,59)	0,157[b]
Median, (Min – Max)	156 (150-69)	155 (150-167)	
Mid upper arm circumference, mean (SD), cm			
Mean (SD)	25,48 (2,16)	24,94 (1,94)	0,367[b]
Median, (Min – Max)	25 (22 – 31)	25 (22 – 29,5)	
Parity, n (%)			
0	8 (25,8)	8 (25,8)	0,796[c]
1	14 (45,2)	13 (41,9)	
2	9 (29)	9 (29)	
3	0	1 (3,2)	

[a]T Independent, [b]Mann Whitney,[c]Kruskal Willis

Based on parity, the subjects in two groups mostly with parity 1 were 14 people (45.2%) in the treatment group and 13 people (41.9%) in the control group. No significant difference was found in the proportion of parity between treatment and control group (p = 0.796).

Table 2 presents the results of abdominal circumference measurements between treatment and control group before and after the intervention (treatment). Before the intervention, the mean abdominal circumference in the treatment group was 154.74 mm with the smallest abdominal circumference 100 mm and the largest 240 mm. In control group, the mean abdominal circumference was 146.39 mm, with the smallest abdominal circumference being 92 mm and the largest being 207 mm. There was no significant difference in abdominal circumference between treatment and control group (p = 0.468) before the intervention.

Table 2. Differences in Abdominal Circumference in Treatment and Control Group

Lingkar Perut, mm	Perlakuan (n = 31)	Kontrol (n = 31)	p
Pre-Intervention			
Mean (SD)	154,74 (37,90)	146,39 (37,23)	0,468[a]
Median, (Min – Max)	149 (100-240)	146 (92-207)	
Post Intervention			
Mean (SD)	288,87 (38,29)	264,75 (32,65)	0,025[a]
Median, (Min – Max)	280 (235-370)	267 (214-311)	

[a]Mann Whitney

After intervention, the mean abdominal circumference in the treatment group was 288.87 mm with the smallest abdominal circumference 235 mm and the largest 370 mm. In control group, the mean abdominal circumference was 264.75 mm with the smallest abdominal circumference 214 mm and the largest 311 mm. There was a significant difference in the size of the abdominal circumference between treatment and control group (p = 0.468) after the intervention.

In treatment group, the mean abdominal circumference before the intervention was 154.74 mm and after the intervention increased to 288.87 mm. There was a significant increase in abdominal circumference in treatment group, before and after the intervention (p < 0.001).

In control group, the mean abdominal circumference before intervention was 146.39 mm and after intervention increased to 264.75 mm. There was a significant increase in abdominal circumference in the control group, before and after the intervention (p < 0.001).

Table 3 . Differences in Abdominal Circumference in Treatment and Control Group Before and After Treatment

Abdominal Circumference, mm	Pre-Intervention (n = 31)	Post Intervention (n = 31)	p
Treatment Group			
Mean (SD)	154,74 (37,90)	288,87 (38,29)	<0,001[a]
Median, (Min – Max)	149 (100-240)	280 (235-370)	
Control Group			
Mean (SD)	146,39 (37,23)	264,75 (32,65)	<0,001[a]
Median, (Min – Max)	146 (92-207)	267 (214-311)	

[a]Wilcoxon

Changes in the size of the abdominal circumference before and after the intervention in two groups showed an increased. In treatment group, the mean abdominal circumference increased by an average of 134.13 mm with the lowest increase of 105 mm and the largest increase of 174 mm. Meanwhile, in control group the mean abdominal circumference increased by an average of 118.23 mm with the lowest increase of 102 mm and the largest increase of 141 mm. There was a significant difference in the size of the abdominal circumference between treatment and control group (p<0.001). This proves that the administration of zinc can significantly increase the size of the abdominal circumference.

Table 4 . Differences in Size Changes of the Abdominal Circumference in Treatment and Control Group Before and After Treatment

Abdominal Circumference Changes, mm	Treatment (n = 31)	Control (n = 31)	p
Mean (SD)	134,13 (13,97)	118,23 (8,47)	<0,001[a]
Median, (Min – Max)	132 (105-174)	119 (102-141)	

[a]Wilcoxon

IV. DISCUSSION

Zinc is a major element for fetal growth and development. Maternal zinc restriction during pregnancy affects fetal growth, whereas optimal zinc supplementation during pregnancy can reduce the risk of preterm delivery.[7] the importance of zinc in biological mechanisms of development is related to its involvement in genetic potential expression, nucleic acid metabolism, and protein synthesis. Marginal zinc deficiency caused by suboptimal dietary intake is estimated to occur in 82% of pregnant women worldwide.[8]

Zinc plays a role in fetal organ development, and deficiency of this micronutrient during the prenatal period has been associated with teratogenic consequences and long-term functional effects on cardiovascular and metabolic function.[9] The effects of zinc on maternal health and pregnancy outcome have been studied in several observational and intervention studies. Studies have linked zinc deficiency to a variety of complications including pregnancy-induced hypertension, bleeding, infection, intrauterine growth retardation, low birth weight, congenital anomalies, and increased neonatal morbidity.[10]

Mild zinc deficiency can also be associated with labor and delivery complications such as prolonged or suboptimal first and second stage of labor, premature rupture of membranes, and the need for assisted or operative delivery. Other primary maternal or neonatal outcomes such as pregnancy-induced hypertension or preeclampsia, ruptured membranes before delivery, antepartum haemorrhage, instrumental vaginal delivery, maternal infection, postpartum haemorrhage, mean birth weight, small for gestational age, and infant morbidities such as sepsis neonatal, respiratory distress syndrome and neonatal intraventricular hemorrhage did not differ between the zinc and control groups.[11]

In this study, the mean age of the subjects in the treatment group was 28.58 years and in the control group was 28.28 years. Not much different from this study, Merialdi et.al. showed that the mean age of mothers who received zinc supplementation and without zinc was 23.5 and 23.4 years, respectively.[8] This was also found in the study by Mispireta which showed the mean age of mothers with zinc and without zinc was 23.5 ± 4.9 and 23.4 ± 4.9 respectively.[9] Farajzadegan showed the mean age of the mother who was given and without zinc supplementation was 25.9_5.9 years and 25.7 ± 4.7 years with serum zinc of 75.2 ± 23.6 g/dl and 85.4 ± 23.8 g/dl respectively.[12]

In this study, the control group had a mean gestational age of 21.13 weeks with the lowest gestational age being 16 weeks and the highest gestational age being 27 weeks. Merialdi found a lower mean gestational age of 13.4 weeks in the group with and without zinc.[8] Hanachi also found the mean serum zinc at gestational age < 11 weeks, 12-19 weeks and > 20 weeks was 91, 02 ± 25.99; 88.62 ± 27.06 and 88.70 ± 25.08 g/dl respectively and zinc deficiency was found to be 16.2%, 16% and 17.3%, respectively. Then it was concluded that there was no correlation between zinc concentration and maternal gestational age.[10]

In this study, there were no significant differences in mean weight, height and mid upper arm circumference in two groups. Merialdi showed the mean BMI in the group of pregnant women with zinc was 23.2 kg/m^2 with a mean height of 152.7 cm and for the group without zinc it was 23.6 kg/m^2 with an average height of 152.3 cm.[8] Mispireta also showed BMI balance between the two groups was 23.2 ± 3.2 kg/m^2 in the zinc group and 23.6 ± 3.4 without zinc.[9] Garcia also showed a mean BMI in all study samples and no other significant differences were found between the groups. With supplementation and without multivitamin supplementation.[13]

Based on parity, the subjects in the two groups mostly with parity 1 were 14 people in the treatment group and 13 people in the control group. In contrast to this study, Merialdi showed that the majority of 58.5% and 58.4% of the sample of pregnant women were nulliparous both with zinc and without zinc.[8] In line with this study, Mispireta showed primiparity of 57% and 56.2% of pregnant women with and without zinc.[9] In contrast to this study, Hanachi et. al. showed a significant correlation between parity and zinc concentration (p<0.05). The results showed that there was a significant relationship (p<0.05) between parity and body weight of early pregnancy participants with serum zinc scores.[10]

V. CONCLUSIONS

There was no significant difference in the mean size of the fetal abdominal circumference between treatment and control group, but there is a significant difference in the size of the fetal abdominal circumference between before and after the administration of zinc tablets. The results of the analysis using the Independent T test concluded that there was a significant difference in the size of the fetal abdominal circumference between the group of mothers who were given zinc tablets and the control group.

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VIII. CONFLICT OF INTEREST

There is no conflict of interest in this research

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