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Original Research Article

EFFECT OF ZINC TABLETS INTERVENTION IN ZINC DEFICIENCY OF TRIMESTER III PREGNANT WOMEN TOWARD WEIGHT AND BODY LENGTH OF NEWBORN

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Abstract

Background: According to 2018 World Health Organization (WHO) data globally, an estimated 17.3% of the population has inadequate zinc intake, with estimates ranging from 5.7% in Oceania to 7.6% in Europe, 9.6% in America and the Caribbean, highest in Africa (23.9%) and Asia (19.6%). Zinc is important for the function of a number of enzymes and growth hormones during pregnancy. In pregnant women, the relative zinc concentration decreases up to 35% due to the influence of hormonal changes and the transport of nutrients from mother to baby.

Objectives: The purpose of this study was to identify the effect of giving zinc tablets to pregnant women with zinc deficiency in the third trimester on body weight and length of babies born at the Makassar City Health Center.

Methods: This type of research is True Experimental with a pretest-posttest design with a control group. The sample in this study was 62 samples of third trimester pregnant women, and the sampling technique used was purposive sampling. Measurement of zinc levels in third trimester pregnant women using the Elisa reader kit at the Research Laboratory of the Hasanuddin University Teaching Hospital. The research instruments were in the form of a research explanation sheet, respondent's consent sheet, respondent's checklist sheet, and the mother's zinc tablet consumption control sheet for 14 days.

Results: Judging from the average value of newborns in pregnant women who did not have zinc deficiency, the average value of birth weight in pregnant women with zinc deficiency was 15.70 g/dL and 18.95 g/dL. zinc deficiency with a value ($p < 0.05$), while pregnant women with zinc deficiency have an average birth length of 10.00 g/dL and mothers who do not have a deficiency of 19.87 g/dL with a value ($p < 0.05$). So, it can be concluded that giving zinc tablets to pregnant women in the third trimester has an effect on Birth Weight (BBL) and Birth Length (PBL).

Conclusion: Giving zinc tablets has an effect on increasing zinc levels in third trimester zinc deficiency pregnant women and increasing birth weight and length of the baby.

Keywords: Zinc tablets, zinc deficiency, body weight and length of babies born.

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INTRODUCTION

Based on the Food and Nutrition Technical Assistance III Project (FANTA), Asian countries are included in the list of countries experiencing a fairly high incidence of malnutrition (chronic energy deficiency and micronutrient deficiency) which is around 10-40% (Rahayu, et al 2019). According to 2018 *World Health Organization* (WHO) data globally, an estimated 17.3% of the population has inadequate zinc intake, with estimates ranging from 5.7% in Oceania to 7.6% in Europe, 9.6% in America and Caribbean, highest in Africa (23.9%) and Asia (19.6%). Pregnant women and children are the highest risk group for zinc deficiency (Lamberti, Walker, & Black, 2019) . Based on research conducted by Gernand, et al in 2016, in South Asia showed that pregnant women who lack zinc are around 15-74%. (Rahayu, Gumilang, Astuti, Nirmala, & Judistiani, 2019) It is estimated that around 82% in the world, pregnant women are very susceptible to zinc deficiency, and most occur in developing countries (Wijaksono, Rasyid, & Mariko, 2019).

Zinc is essential for normal fetal growth and development. Zinc intake is especially important during pregnancy, when cell production is very rapid. Pregnant women are prone to zinc deficiency so they need a lot of zinc intake. Normal zinc levels are 70-115 g/dL (Çelikel, Doğan, & Aksoy, 2017) . The impact of zinc deficiency on pregnant women can also cause abortion, premature birth, fetal death in the womb, and *NTD (Neglected, Tropical Disease)* (Gumilang et al, 2019).

In the process of accelerating growth, zinc is needed, not only because of the effects of cell replication and nucleic acid metabolism, but also as a mediator of growth hormone activity. Zinc is needed by pregnant women, especially in the third trimester. Zinc levels in pregnant women affect fetal growth, brain development, and the development of the fetal immune system (Gultom & Indriyani, 2020). A good zinc intake can reduce the risk of preterm birth by 14% (Rahayu, et al 2019).

METHODS

Study Design

This type of research used true experimental with a pretest-posttest design with a control group where the researcher measures the effect of treatment (intervention) on the experimental group by comparing the group with the control group.

Setting

This research was conducted at the Makassar City Health Center, namely Antang Perumnas Health Center, Kassi-Kassi Health Center, Bara-Baraya Health Center and Jumpandang Baru Health Center. The study was carried out from March 22 to June 22 2021 at the Makassar City Health Center.

Research Subject

The population in the study were all 168 third trimester pregnant women who visited ANC (Antenatal Care) from 4 puskesmas in the Makassar city area during the study from March 22 - June 22, 2021. The total sample was 62 samples based on the calculation results from the determination formula the number of samples to test the hypothesis on the population mean. The sampling technique used purposive sampling in accordance with the inclusion criteria. The inclusion criteria were pregnant women in the third trimester, 28-35 weeks of gestation, gave birth vaginally with term, singleton pregnancies, and normal babies born alive, and were willing to be respondents and cooperatives.

Instruments

The research instrument was a research explanation sheet, respondent's consent sheet, respondent's checklist sheet containing the identity of the respondent, anamnesis data, maternal nutritional status, measurement of maternal zinc levels and infant anthropometric data, as well as a control sheet for maternal zinc tablet consumption for 2 weeks. In addition, the tools used in this study were a scale to measure the weight of a baby born, a meter to measure the length of a baby's body at birth. The material used in this study was in the form of blood samples of pregnant women in the third trimester of gestation from 28-35 weeks and in the form of 20 mg zinc tablets.

Intervention

The 62 samples of pregnant women in the third trimester who met the inclusion criteria and based on the consent of the respondents, a pretest was carried out first by taking 3 ml of blood samples through the veins of pregnant women to be examined for zinc levels using the Elisa reader kit at the Research Laboratory of the University Teaching Hospital. Hasanuddin. After the results of the mother's zinc levels came out, pregnant women with zinc serum levels below 70 g/dL (Zinc deficiency) were given an intervention of 20 mg/day of zinc tablets which were monitored through the control sheet for the consumption of the mother's zinc tablets for 14 days, while mothers with normal zinc levels ie above 70 g/dL only given counseling and monitored for 14 days. After 2 weeks of treatment between the intervention group and the control group, a posttest was carried out by taking a second blood sample of 3 ml from both groups and measuring the mother's zinc levels again and looking at the comparison between the intervention group, namely mothers who were given zinc tablets and the control group, namely mothers who were only given zinc. counseling only without being given zinc tablets. After the mother gave birth, compared the increase in maternal zinc levels, weight and length of the baby born from the intervention group and the control group.

The results of the measurement of maternal zinc levels during the third trimester of pregnancy were taken from laboratory results, while data on the weight and length of the baby's body were taken from the medical records of the respondents, each of which was recorded on the respondent's checklist.

Data Analysis

To analyze the effect of giving zinc tablets to pregnant women with zinc deficiency in the third trimester on body weight and length of the baby born, statistical analysis of the Mann-Withney test was used.

Ethical Consideration

This research has received ethical approval recommendations from the Health Research Ethics Commission, Faculty of Medicine, Hasanuddin University with Recommendation Number 118/UN4.6.4.5.31/PP36/2021 with Protocol Number UH21010047 on February 26, 2021.

RESULTS

Characteristics of Mothers

Table 1. Distribution Frequency of Mothers in the Makassar City Health Center, namely Antang Perumnas Health Center, Kassi-Kassi Health Center, Bara-Baraya Health Center and Jumpandang Baru Health Center on March 22 - June 22, 2021.

Characteristics of Mothers	Frequency (f)	Percentage (%)
Age (years)		
< 20	9	14.5
20-35	52	83.9
> 35	1	1.6
Educational Level		
No School	0	0.0
Elementary-Senior High School	52	89.3
College/ University	10	16.1

Characteristics of Mothers	Frequency (f)	Percentage (%)
Occupational		
IRT/ Not Working	51	82.3
Private Sector Employee	10	16.1
Civil Servant	1	1.6
Income (Rupiahs)		
None	51	82.3
Less than 2 Million	5	8.1
More than 2 Million	6	9.6

Sources: Primary Data of Questionnaire, 2021.

In table 1, it is known that the average age of the mother is at the age of 20-35 years by 83.9%, for the average mother's education at the elementary-high school education level with a percentage of 83.9%, for work the mother is on average in the IRT group with a percentage by 82.3%, while for the income of mothers the largest percentage in the income group is Rp. 0 by 82.3%, while for the 2 million income group it is 8.1% and in the 2 million income group it is 9.6%.

Characteristics of Infants

Table 2. Distribution Frequency of Infants in the Makassar City Health Center, namely Antang Perumnas Health Center, Kassi-Kassi Health Center, Bara-Baraya Health Center and Jumpandang Baru Health Center on March 22 - June 22, 2021.

Characteristics of Infants	Frequency (f)	Percentage (%)
Gender		
Boy	35	56.5
Girl	27	43.5
Birth Weight		
Normal	56	88.7
LBW	6	11.3
Birth Body Length		
Normal	51	74.2
Short	11	25.8

Sources: Primary Data of Questionnaire, 2021.

In table 2, it is known that based on gender there are 35 male and 27 female babies, with normal weight 56 babies and 6 babies experiencing LBW, while for Birth Body Length (PBL) 51 babies with normal body length and 11 babies with short body length.

Comparison of Birth Weight and Birth Length in Pregnant Women that were Taken Zink Tablets and Counseling

Table 3. Comparison of Birth Weight and Birth Length in Pregnant Women that were Taken Zink Tablets and Counseling in the Makassar City Health Center, namely Antang Perumnas Health Center, Kassi-Kassi Health Center, Bara-Baraya Health Center and Jumpandang Baru Health Center on March 22 - June 22, 2021.

	Taken Zinc Tablets		Counseling	
	Frequency (f)	Percentage (%)	Frequency (f)	Percentage (%)
Birth Weight (BBL) (Grams)				
Normal	35	56.6	21	33.9
Low Body Weight	1	1.6	5	8.1
Birth Body Length (PBL) (Centimeters)				
Normal	34	54.8	17	27.4
Short	2	3.2	9	14.5

Sources: Primary Data of Questionnaire, 2021.

In table 3, the percentage of babies born with normal weight was 56.6% in the zinc tablet group and 33.9% in the counseling group, for babies with low birth weight in the zinc administration group it was 1.6% and 8.1% in the counseling group, while the percentage for body length Normal in the zinc administration group was 54.8% and 27.4% in the extension group, body length in the short category in the zinc administration group was 3.2% and 14.5% in the extension group.

From the table above, it is known that the highest percentage of birth weight was in the zinc administration group with a percentage of 56.6% and the lowest LBW rate was in the zinc tablet group with a percentage of 1.6%, while for birth length the highest percentage was for birth length in the normal body length category. found in the group giving zinc tablets with a percentage of 54.8% and the lowest percentage in birth length with a short category was in the group giving zinc tablets with a percentage of 3.2%.

Bivariate analysis in this study was used to examine differences in body weight and length of babies born from the zinc intervention group and the control group who were not given zinc tablets. However, before testing the normality of the data using the *Kolmogorov-Smirnov test,* which was carried out in this study, the p value (0.00) < 0.05 which indicates that the data is not normally distributed, then the analysis of the conclusion in this study uses the *Mann-Whitney* test analysis.

Comparison of Zink Levels in Pregnant Women which were Taken Zink Tablets and Explanation

Table 4. Comparison of Zink Levels in Pregnant Women which were Taken Zink Tablets and Explanation in the Makassar City Health Center, namely Antang Perumnas Health Center, Kassi-Kassi Health Center, Bara-Baraya Health Center and Jumpandang Baru Health Center on March 22 - June 22, 2021.

		Zinc Level (µg/dL) Mean ± SD		Min - Max	
	N	Pre	Post	Pre	Post
Zinc Tablets	36	70.54- 9.07	72.94- 10.89	20.02 – 69.39	51.02 – 88.49
Counseling	26	70.62- 5.29	71.01- 6.84	56.28 – 81.26	34.00 – 87.98

Sources: Primary Data of Questionnaire, 2021.

Based on table 4, it appears that the average value of zinc levels in pregnant women before being given zinc tablets was 70.54 g/dL with a min-max value of 20.02 – 69.39 and after being given zinc tablets it increased by 72.94 g/dL with a min-minx value of 51.02 – 88.49 while for the counseling class before the counseling the average value of zinc levels was 70.62 g/dL with a min-max value of 56.28 – 81.26 and after counseling it also increased by 71.01 g/dL with a min-max value of 34.00 – 87.98.

Analysis of Differences BBL and PBL in Pregnant Women in Intervention and Control Group using Mann-Whitney Test

From table 5, it is known that the average birth weight in the intervention class is 35.82 and, in the control, class is 25.52 with a *p*-value of .026 while the birth length in the intervention class is 38.19 and for the control class is 22.23 with a *p*-value. value of (.000), the *p*-value on birth weight and birth length (< .05) which means there is a significant difference between the group giving zinc tablets to third trimester pregnant women and the group giving counseling to third trimester pregnant women on weight birth weight and birth length in infants.

Table 5. Analysis of Differences BBL and PBL in Pregnant Women in Intervention and Control Group using Mann-Whitney Test.

	n	Mean Rank	*p*-value
BBL (gr)			
Taken Zinc Tablets	36	35.82	.026
Counseling	26	25.52	
PBL (cm)			
Taken Zinc Tablets	36	38.19	.000
Counseling	26	22.23	

Sources: Primary Data of Questionnaire, 2021.

Effect of Zink Tablets on Birth Weight and Birth Length using Mann-Whitney Test

Table 6. Effect of Zink Tablets on Birth Weight and Birth Length using Mann-Whitney Test.

Zinc Tablets	Frequency	Mean-Rank	*p*-value
BBL (gr)			
Deficiency	5	15.70	0.035
No Deficiency	31	18.95	
PBL (cm)			
Deficiency	5	10.00	0.033
No Deficiency	31	19.87	

Sources: Primary Data of Questionnaire, 2021.

From the table 6 found that the number of samples given zinc tablets as many as 36 pregnant women in the third trimester, there are 5 pregnant women who have zinc deficiency and 31 pregnant women who do not have zinc deficiency with an average birth weight of pregnant women with zinc deficiency of 15.70 and 18.95, in pregnant women who do not experience zinc deficiency with *p*-value of < (.05), while pregnant women who experience zinc deficiency with an average birth length of 10.00 and mothers who do not have a deficiency of 19.87 with *p*-value of (< .05). So, it can be concluded that giving zinc tablets to pregnant women in the third trimester has an effect on Birth Weight (BBL) and Birth Length (PBL).

DISCUSSION

This study discusses the administration of zinc tablets to pregnant women with zinc deficiency in the third trimester of the baby's birth weight and length, which aims to determine the effectiveness of zinc tablets in increasing the value of zinc levels in third trimester pregnant women who have zinc deficiency. This study was conducted in 4 health centers with a total sample of 62 pregnant women in the third trimester.

Based on the results of the study in Table 5, the highest percentage of birth weight was in the zinc tablet group with a percentage of 56.6% and the lowest LBW rate was in the zinc tablet group with a percentage of 1.6% while the highest percentage of birth length was in the normal body length category. in the group giving zinc tablets with a percentage of 54.8% and the lowest percentage on birth length with a short category was in the group giving zinc tablets with a percentage of 3.2%. So that there are differences in birth weight and birth length in mothers who are given zinc tablets and given counseling. In table 6 pregnant women who do not have zinc deficiency with an average birth weight of pregnant women who experience zinc deficiency of 15.70 and 18.95 in pregnant

women who do not have zinc deficiency with a p value (<0.05), while in pregnant women who experienced zinc deficiency with an average birth length of 10.00 and mothers who did not have a deficiency of 19.87 with a p value (< 0.05). So, it can be concluded that giving zinc tablets to pregnant women in the third trimester has an effect on Birth Weight (BBL) and Birth Length (PBL).

This is in accordance with research conducted by Dewi, et al (2017) that zinc supplementation in third trimester pregnant women can increase maternal serum zinc levels, this can be seen in the treatment group, statistically there is a difference in the average serum zinc level between the pre-test with posttest (p < .05) with an increase in the average serum zinc level of 62.95 g/dl. Babies born to mothers who received zinc supplements were significantly heavier than babies born to mothers in the control group, with the greatest difference when supplementation started in the third trimester of pregnancy (Dewi, Wirjatmadi, & Adriani, 2017).

A similar study by Wijaksno, et al (2019) entitled the analysis of the relationship between zinc levels of pregnant women at term and baby's birth weight. From the results of the analysis, it appears that there is a significant relationship between zinc levels of pregnant women at term and the birth weight of their babies, with a positive relationship direction, (p = 0.000). Zinc levels of pregnant women by 0.879% affect birth weight. Thus, it can be interpreted that mothers with normal zinc levels will give birth to babies with normal weight, and vice versa (Wijaksono, Rasyid, & Mariko, 2019). The more frequency of consuming food sources that contain lots of zinc, the higher the serum zinc level. This shows that zinc levels in serum are not only affected by supplementation, but also influenced by zinc intake from food (Dewi, Wirjatmadi, & Adriani, 2017) (Lamberti, Walker, & Black, 2019).

One of the effects of zinc on the fetus in the womb is the growth of body length. Zinc deficiency during pregnancy has a negative impact on the endocrine which eventually causes growth failure. Zinc has a role in growth hormone or Growth Hormone (GH), gonadotropins, sex hormones, prolactin, thyroid, and corticosteroids. When the mother takes zinc supplements, it can increase the mother's appetite so that it can increase nutrition for the mother and the placenta and ultimately increase the weight of the fetus. This Growth Hormone (GH) has an important role in the production of IGF-1 (Growth Insuline Like Hormone) which plays a role in the formation of osteoblasts and thus affects bone growth. placenta, thus affecting the length of the baby's body. Several enzymes and growth hormones that play an important role in growth after birth require zinc during pregnancy, such as placental alkaline phosphatase which stimulates DNA synthesis and cell proliferation during pregnancy. Zinc levels in bone are higher than in other tissues. In its development, zinc not only plays a role in transcription factors and enzymes that catalyze DNA and RNA, but also activates growth genes. (Wijaksono, Rasyid, & Mariko, 2019) (Gultom & Indriyani, 2020). In this study, zinc supplements in addition to increasing maternal zinc levels also affect the length of the baby's body where zinc levels increase IGF-1 levels which play an important role in the formation of osteoblasts in the fetus. However, mothers whose height was between 145 cm - 150 cm on average gave birth to babies with short body lengths, but the zinc levels of the intervention group mother whose height was below 150 cm continued to increase due to nutritional intake and zinc supplements consumed by mothers. mother's height and baby's body length that the high prevalence of stunting found in this study which reached 41.2% did not have anything to do with the respondents' low zinc intake. Babies born with a body length below 48 cm (short) could be caused by other factors such as genetics or low socioeconomic conditions so that the purchasing power of respondents towards potential food ingredients as an energy source is low. Because until now the consensus and the

causes of stunting are still being debated about whether it is caused by genetic or environmental factors that are more influential on growth. (Sudirman, 2017)

In a hypothesis it is said that zinc deficiency in pregnancy is related to fetal growth through placental development and function (Gultom & Indriyani, 2020). In addition, zinc deficiency can increase the risk of maternal complications such as hypertension, preeclampsia, intrapartum bleeding, infection, prolonged labor, premature birth, congenital abnormalities, stunted fetal growth, and low birth weight. Zinc intake is very important during pregnancy and has an important role for normal fetal growth and development, because zinc can affect cell production quickly and at the end of pregnancy is a period where zinc is needed (King, 2018) (Gumilang et al, 2019) (Ardiaria, 2017).

CONCLUSION

Based on the results of research and data analysis conducted, the following conclusions can be drawn:

a. Giving zinc tablets to pregnant women with zinc deficiency in the third trimester increases zinc levels in pregnant women.
b. Giving zinc tablets to pregnant women with zinc deficiency in the third trimester increases Birth Weight (BBL).
c. Giving zinc tablets to pregnant women with zinc deficiency in the third trimester increases Birth Body Length (PBL).

SUGGESTIONS

Future researchers are expected to be able to develop this research by linking factors that influence the intake of other nutrients with zinc intake in pregnant women, so that they can carry out appropriate interventions according to the causative factors.

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DECLARATION OF CONFLICTING INTEREST

There is no conflict to occurred in this study.

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AUTHOR CONTRIBUTION

Nurfadhilah S: Researcher and designed the study, collected and analyzed data, and contributed to the completion of the research and article

Wardihan Sinrang: Supervisor contributed to the completion of the research and article

Suryani As'ad: Supervisor contributed to the completion of the research and article

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