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Research Article
Relationship Between Serum Zinc Concentration with Post-partum Depression among Women in Coastal Area of Indonesia

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Abstract

Background and Objective: Women in coastal area have limited access to nutritious diet and vulnerable to micronutrient deficiencies, including zinc. Zinc deficiency is believed to play an important role in the development of mood disorders such as post-partum depression. Therefore, we aimed to determine the relationship between serum zinc concentration and post-partum depression among women in coastal area of Indonesia. **Materials and Methods:** Edinburgh Postnatal Depression Score (EDPS) was administered to 87 post-partum women to determine the post-partum depression symptoms. Serum zinc was measured with ELISA method using Bio Assay Quanti Chrome Zinc Assay Kit (DIZN-250). Data was analyzed using chi-square and Pearson correlation test. **Results:** Results showed that 35.5% of mothers experienced post-partum depression symptoms and 57.4% of mothers had very low serum zinc. There was no significant relationship between serum zinc level and postpartum depression ($p = 0.729$). Moreover, Pearson correlation test shows a weak correlation between serum zinc concentration and EPDS score ($r = -0.063$, $p = 0.564$). Although not significant and weak, this inverse correlation indicated that as the serum zinc concentration increased the EPDS score decreased. **Conclusion:** There was no significant relationship between serum zinc level and postpartum depression, however, high percentage of women with post-partum depression symptoms and zinc deficiency implies that more attentions should be placed to post-partum women's mental health and zinc status.

Key words: Coastal area, depression, Indonesia, micronutrient, postpartum, women's health, zinc deficiency

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

One type of depression that usually occurs in mothers is postpartum depression (PPD). After delivery, the mother will usually experience psychological changes[1]. Globally, the prevalence of DPP is around 10-15%[2,3]. In developed countries such as the United States and Canada, the prevalence of PPD is around 15 and 8%, respectively. Although the prevalence of PPD is believed to be higher in developed countries, recent studies shows increase prevalence of PPD in developing countries. In low middle income countries such as South Africa and India, the prevalence of PPD is around 35 and 11%, respectively[4,5]. In Indonesia, the prevalence of PPD ranged from 19.7% in Makassar to 20.5% in Denpasar, Bali[6,7].

Besides facing the risk of mental health disorders, women in developing countries are also facing the risk of micronutrient deficiency. Women in developing countries, especially in disadvantage area, such as coastal area usually have low social-economic status and limited access to nutritious diet. South-Sulawesi is one of provinces that surrounded by coastal area in Indonesia. The prevalence of zinc deficiency was found high among women in South-Sulawesi[8,9]. A study in Gowa Regency, South Sulawesi found that all of respondents who were pregnant women had low zinc serum concentration[8]. Moreover, another study found that out of 70 post-partum women who gave birth in local Women and Children Hospital, Makassar, South Sulawesi, 100% of them had low zinc serum concentration[9].

Zinc deficiency is believed to play an important role in the development of mood disorders. Zinc acts as a neuroreceptor and neurotransmission in human nerve system[10]. Zinc has a direct or indirect effect on glutamatergic balance[11]. The relationship of serum zinc and mood disorders was seen to be consistent at various ages, from young adults to old age[12,13]. Some studies also show a tentative relationship between zinc and mood regulation in infants and children[14].

Besides being associated with depression in general, zinc also plays a role in the occurrence of PPD in the mother[15]. A cohort study with zinc supplementation experiment found that serum zinc levels were associated with the severity of PPD among mothers[16]. Present study aimed to determine the relationship of serum zinc and post-partum women residing in coastal area of Makassar, Indonesia.

MATERIALS AND METHODS

Experimental site: Respondent's characteristics data, EPDS and blood sample were collected from postpartum women attending three community health centers that located in coastal area of Makassar, Indonesia. Serum zinc was analyzed in Hasanuddin University Medical Research Centre (HUMRC), Makassar.

Materials and research tools: Indonesian version of EPDS was completed by participants to identify the post-partum depression symptoms. Serum zinc analysis was carried out using the BioAssayQuantiChrom Zinc Assay Kit (DIZN-250) (BioAssay Systems, Hayward, CA).

Research procedure: To determine the serum zinc concentration of the participants, 3cc blood sample was drawn from each participant by the health professionals who worked in each selected community health center. Blood then was centrifuged in the Hasanuddin University Medical Research Centre to separate the blood serum and was refrigerated at -20°C. After completing all blood sample collection, blood serum was analyzed with ELISA method using BioAssayQuantiChrom Zinc Assay Kit (DIZN-250) (BioAssay Systems, Hayward, CA, USA).

Data collection: Data collection was conducted between August-November 2018.

Experimental design: This study is a cross-sectional study. Participants were selected using purposive sampling technique with inclusion criteria: (1) Mothers who have given birth at least after 4 weeks, (2) Do not take zinc supplements, (3) Do not suffer from severe infections and (4) Mothers provides consent to participate in the study. This study has been approved by Ethics Committee of Public Health Faculty of Hasanuddin University. Individual informed consent was obtained from the participants.

Parameters measured: Parameters measured in this study were serum zinc and EPDS score. Normal serum zinc was considered as 66 mcg dL^{-1}. However, after the data was analyzed, all of respondents' serum zinc were below normal. Therefore, low and very low serum zinc level was used as category in this study. Serum zinc < mean value was considered as very low while serum zinc ^{3} mean value was considered as low. Mean serum zinc in this study was 6.30 mcg dL^{-1}.

EPDS questionnaire consisted of 10 questions, each question is rated from the lowest score (0) to the maximum score (3). Therefore, the maximum total score of EPDS is

30 and the minimum is 0. Cut off score of 13 was used in this study to determine the PPD symptoms. Total score <13 was considered as there not having PPD symptoms while total score equal to 13 or more was considered as having PPD symptoms.

Statistical analysis: Statistical analysis was performed using SPSS version 18 (SPSS Inc, Chicago, USA). Descriptive analysis was performed to describe proportions of the participants according to their socio-demographic characteristics. Relationship between the categorical data was analyzed using chi-square test and for continuous data was analyzed using Pearson correlation test. Data normality was examined using P-P Plot, indicating a normal distribution. In all analysis, $p<0.05$ was considered as statistically significant.

RESULTS

Socio-demographic characteristic of respondents: Majority of respondents were20-29 years old (59.8%) and had less than 4 children (88.5%). Only 28.7% of respondents identified their pregnancy as primipara and only 5.7% of respondents had miscarriage or abortion history. More than 50% of respondents belonged to low-mid class families and 81.6% of respondents were housewives. However, more than 60% of mother and their partners had completed 9-year of compulsory education. (Table 1)

Out of 87 mothers, 30 (34.5%) had post-partum depression symptom and 50 (57.4%) had very low serum zinc concentration. There was no significant association between post-partum depression and serum zinc level ($p = 0.079$) (Table 2). Moreover, based on Pearson correlation test, the

Table 1:The socio-demographic characteristics of respondents (n = 87)

Characteristics		No.	Percentage
Age	<19 years old	5	5.7
	20-29 years old	52	59.8
	30-49 years old	30	34.5
No. of children	1-3	77	88.5
	4 or more	10	11.5
Pregnancy	Primipara	25	28.7
	Multipara	62	71.3
Miscarriage/abortion history	Yes	5	5.7
	No	82	94.3
Employment	Civil servant	2	2.3
	Private employee	8	9.2
	Entrepreneurs	3	3.4
	Unemployed	71	81.6
	Others	3	3.4
Husband employment	Civil servant	2	2.3
	Police/army	3	3.4
	Private employee	24	27.6
	entrepreneurs	32	26.8
	Laborer	20	23.0
	Fisherman	1	1.1
	Others	5	5.7
Education	Primary school	9	10.3
	Junior high school	15	17.2
	Senior high school	37	42.5
	Diploma	8	9.2
	Graduate	17	19.5
	Post graduate	1	1.1
Husband's education	Primary school	9	10.3
	Junior high school	18	20.7
	Senior high school	41	47.1
	Diploma	4	4.6
	Graduate	13	14.9
	Post graduate	2	2.3
Average monthly family income	<Rp 1.500.000	18	20.7
	1.500.000-2.500.000	30	34.5
	2.500.000-3.500.000	25	28.7
	>3.500.000	14	16.1

Relationship between serum zinc concentration and post-partum depression

Table 2: Relationship between serum zinc and postpartum depression

	Serum zinc concentration					
	Low		Very low			
Postpartum depression	No.	Percentage	No.	Percentage	Total (%)	p-value*
Yes	12	32.4	18	36.0	30 (34.5)	0.729
No	25	67.6	32	64.0	57 (65.5)	
Total	37	100.0	50	100.0	87 (100)	

*chi-square test

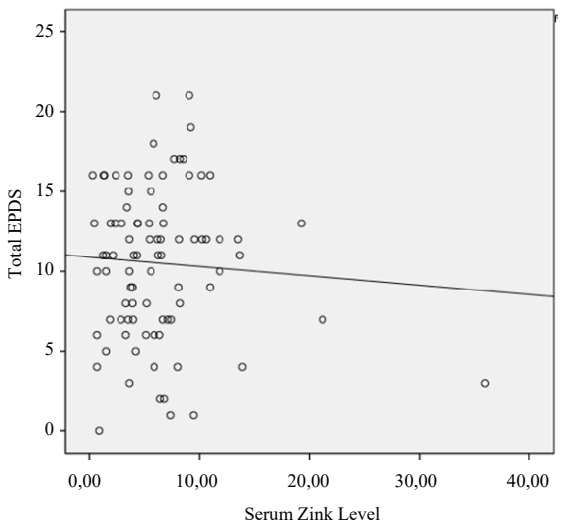

Fig. 1: Scatter plot of EPDS total score for serum zinc concentration

correlation of serum zinc level and total EPDS score was weak and not significant (r = -0.063, p = 0.564). However, the inverse correlation between serum zinc and PPD indicates that as the serum zinc level increased the EPDS score decreased (Fig. 1).

DISCUSSION

Present study suggests that there was high number of women who resides in coastal area of Makassar had low serum zinc concentration and PPD symptoms. Zinc concentration of the women was not significantly associated with PPD symptoms. Moreover, the correlation between those variables was weak. However, the inverse correlation indicates that the EPDS score was decreasing along with the increase of serum zinc concentration.

In this study it was found that the average total EPDS score was quite high and the percentage of mothers who had postpartum depression symptoms was higher than previous studies. This study found that 34.5% of mothers had symptoms of postpartum depression. In a previous study in Makassar it was found that 19.7% of women experienced postpartum depression while in Bali the prevalence was 20.5%[6,7]. The results of this study are similar to the results of studies in other developing countries such as in South Africa which found the percentage of maternal PPDs to be between 34-35%[2,17]. In this study the EPDS questionnaire was self-administered questionnaire because there were no illiterate respondents in this study. A self-administered questionnaire allows respondents to be more open in answering the questions asked and to minimize bias.

All respondents had serum zinc levels that were below normal and more respondents had very low zinc levels. It is surprising since the women were residing in coastal area where presumably the place that zinc sources would be highly available. This finding is in line with previous research in the city of Makassar which found low zinc levels in all respondents of pregnant women and postpartum mothers[8,9]. Other studies also show that 90.6% of pregnant women in Indonesia experience zinc deficiency[10].

There was no relationship observed between zinc serum level and postpartum depression. However, the correlation test results showed a weak inversion correlation between zinc serum level and postpartum depression. This is in line with the results of a meta-analysis showing that zinc serum levels in depressed patients were lower than individuals who were not depressed[11,14,18,19]. A study in the general population in Boston showed that low zinc intakes from both food and supplements can increase the risk of depressive symptoms in women[20]. in According to the results of the present study low zinc serum of postpartum women could be due to low zinc intake from their daily diets.

The difference in the results of these studies can be caused by differences in socio-cultural background and socio-economic conditions at the study site. Studies that show an association between zinc serum levels and postpartum depression are mostly carried out in Western countries and in developed countries. A study conducted in developing countries and in Asia (Iran) shows results that are in line with our research. Previous study in developing country shows that there was no relationship between zinc and postpartum

depression levels[21]. It can indicate that PPDs in women of this particular setting might be due to other factors than zinc nutrition, since postpartum depression can be related to multifactorial causes.

Based on the results, it is necessary to paid more attention to post-partum women's mental health and micronutrient status, particularly zinc. More health programs related to the prevention of post-partum depression and better nutrition for mothers particularly residing in coastal area, must be developed. Moreover, it is crucial to produce local foods which provides high content and high-bioavailability of zinc to be provided for women living in coastal area in order to improve their zinc status. We acknowledge some limitations in this study, such as small sample size and sample was not recruited randomly, which might affect the external validity of the results.

CONCLUSION

This study found a weak, non-significant, correlation between serum zinc concentration and PPD among women residing in coastal area of Indonesia. However, there was an alarming number of women with PPD as well as low zinc status. Therefore, more attention should be paid to post-partum women's mental health and micronutrient status in this particular setting.

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